Family 14. ORTHOTRICHACEAE

By Abel Joel Grout

Often dark-colored plants growing in tufts or mats on trees or rocks. Stems without a central strand, erect or long-creeping with many erect secondary stems, these simple or sparingly branched above. Leaves mostly unistratose, or frequently bistratose in parts, crowded, appressed to crispate or spirally twisted when dry, spreading to squarrose when moist, keeled, often concave at the base, lanceolate to ovate-lanceolate, less frequently ligulate or lingulate, often bearing septate brood-bodies; margins mostly entire and revolute; costa strong, nearly or quite percurrent, rarely excurrent; upper leaf-cells small, usually 8–15 μ in their longest dimension and irregularly rounded, incrassate and papillose or mammillose on both sides, the basal cells rectangular, rhomboidal, or linear, often colored. Perichaetial leaves little different except in *Amphidium*. Inflorescence varied. Sporophytes terminal in the Orthotricheae, mostly lateral in the Macromitrieae. Capsules immersed to exserted, erect and symmetric, often long-necked or pyriform, mostly ovoid to oblong-cylindric, often 8-plicate when dry. Annulus when present of small, little-differentiated cells. Exothecial cells differentiated along the ribs when these are present. Stomata in the neck or around the lower spore-case, either immersed or superficial. Peristome usually present and double, the teeth sometimes with a preperistome, 16, often united in pairs, often striate or papillose in a manner characteristic of the species; segments of the inner peristome almost without a basal membrane, slender, thin and hyaline, often papillose, 8 or 16, alternate with the teeth, often lacking. Operculum convex to conic-rostrate. Calyptra mostly hairy, mitrate, often campanulate, rarely cucullate, with or without plicae or folds.

Creeping stems (with few exceptions) short or lacking. — Tribe 1. Orthotricheae.
Primary stems long and creeping, sending up numerous short, densely foliate branches; plants almost pleurocarpous in habit. — Tribe 2. Macromitrieae.

Tribe 1. ORTHOTRICHEAE. Characterized as indicated in the key.

Leaves plainly crispate when dry.
- Stomata cryptopore; basal marginal leaf-cells scarcely differentiated. Subsect. *Pulchella* in — 1. Orthotrichum.
- Stomata phaneropore; basal marginal leaf-cells generally either wider or narrower than the others.
  - Perichaetial leaves plainly different (except in *A. californicum*). — 3. Amphidium.
  - Perichaetial leaves not materially different.
    - Calyptra hairy. — 2. Ulota.
    - Calyptra (in our species) not hairy. — 4. Zygodon.

Leaves not crispate, occasionally somewhat contorted or twisted when dry.
- Calyptra cucullate, not plicate nor hairy; stomata superficial. — 4. Zygodon.
- Calyptra mitrate, conic-campanulate, often plicate or hairy or both.
  - Basal marginal leaf-cells shorter and more nearly hyaline; stomata phaneropore. — 2. Ulota.
  - Basal marginal leaf-cells not markedly different. — 1. Orthotrichum.

1. ORTHOTRICHUM Hedw. Sp. Musc. 162. 1801.

Plants growing chiefly in temperate and subalpine climates, usually in small tufts or cushions on trees, less frequently on rocks, mostly dark green to brownish except in the young

growing parts. Leaves mostly lanceolate, hygroscopic, spreading when moist,* appressed when dry, only rarely much contorted or crisped, generally recurved to revolute at the margins; upper leaf-cells small, little longer than broad, angular to rounded, usually papillose, the papillae usually much more conspicuous on young leaves; lower leaf-cells often less incrassate, quadrate to rectangular, less dense, usually smooth at or near the insertion,† less incrassate and shorter in young leaves. Base of the short seta inserted in a minute cup-like sheath, the ochrea. Capsules immersed to emergent, sometimes fully exserted, usually with 8–16 regular folds or plicae forming ribs when dry, occasionally smooth (the folds consisting of larger and darker cells than the intervening exothecial walls), elliptic or pyriform to cylindric, with a more or less tapering neck, sometimes constricted below the mouth, especially when old. Calyptra campanulate, usually hairy, lobed at the base, plicate. Peristome of 16 broadly lanceolate teeth, often united in pairs, often recurved when dry, sometimes erect at first and when old recurved (lacking in *O. gymnostomum*); inner peristome, when present, of 8 or 16 segments, often called cilia. Stomata scattered, often nearly covered by exothecial cells (immersed). Annulus of small thin cells with a cavity.

Type species, *Orthotrichum anomalum* Hedw.

See Grout, Moss Fl. N. Am. 2: 107.

Leaves without hyaline points, rarely with 1–4 hyaline apical cells.
  Leaf-margins plane or involute throughout.
    Leaf-margins plane or slightly incurved; peristome present. 18. *O. obtusifolium.*
    Leaf-margins strongly involute; peristome lacking. 19. *O. gymnostomum.*
  Leaf-margins revolute for at least a portion of their length.
    Stomata superficial (phaneropore). KEY A.
    Stomata immersed (cryptopore). KEY B.
Leaves with long, serrate, hyaline apices. 43. *O. diaphanum.*

KEY A

Plants growing on rocks;‡ peristome-teeth mostly erect to spreading when dry.§
  Leaf-margins plane in the upper one-half. 6. *O. Bolanderi.*
  Leaf-margins revolute nearly to the apex in mature leaves.
    Capsules immersed to emergent.
      Leaves slender-pointed; peristome-teeth mostly reflexed when dry. 13. *O. microblepharum* var. *praemorsum.*
      Leaves obtuse to broadly acute; peristome-teeth mostly erect when dry.
        Peristome-teeth lightly papillose to nearly smooth. 1. *O. rupestre.*
        Peristome-teeth warty or irregularly roughened at the base. 2. *O. texanum.*
    Capsules exserted or nearly so.
      Capsules strongly ribbed when dry. 13. *O. microblepharum.*
      Capsules smooth except when old and empty.
        Peristome-teeth striate. 4. *O. Roellii.*
        Peristome-teeth papillose.
          Leaves blunt to broadly obtuse. 5. *O. laevigatum.*
          Leaves abruptly acute to slender-pointed.
            Capsules oblong-cylindric; peristome-teeth rarely perforate. 3. *O. Macouni.*
            Capsules ovoid-pyriform with a long neck; peristome-teeth perforate. 8. *O. fenestratum.*
Plants growing on trees; peristome-teeth mostly reflexed to revolute when dry.
  Dioicous.
    Plants small; leaves about 1 mm. long; peristome-segments fully as wide as the teeth; southeastern U. S. 20. *O. exiguum.*
    Plants larger; leaves 3–4 mm. long; peristome-segments linear-filiform; western U. S. 16. *O. Lyellii.*

* Water seems to be absorbed more rapidly on the inner face of these basal cells than on the outer surface, for the leaves are often recurved when first moistened but straighten in a few minutes.

† Apparently the size and translucency of the basal cells depend largely on the size, vigor, and rapidity of growth of the plants.

‡ Rupestral species are often found at the base of trees and arboreal species are frequently found on soil rich in vegetable matter. *O. alpestre* seems to grow well on either substratum.

§ Many species have the peristome erect until a considerable time after dehiscence, and later spreading to recurved.

Monoicous.
Capsules nearly or quite exserted.
Plants rarely over 1 cm. in height; capsules smooth even when old; east of the Rocky Mountains. 15. *O. elegans.*
Plants larger; capsules more or less ribbed when old; west of the Rocky Mountains.
Capsules smooth until old and empty; frequent in its range. 14. *O. speciosum.*
Capsules plicate when mature and dry.
Leaves nearly smooth; capsules long-exserted; peristome-teeth smooth but with a strong preperistome. 7. *O. Holzingeri.*
Leaves strongly papillose; capsules immersed to barely exserted; peristome-teeth granulose without a preperistome. 9. *O. cancellatum.*
Capsules immersed to emergent.
Capsules completely immersed, smooth when dry. 17. *O. striatum.*
Capsules immersed to emergent, more or less ribbed when dry; exothecial cells plainly differentiated along the ribs.
Capsules immersed to slightly emergent when moist, pyriform; eastern U. S. 12. *O. sordidum.*
Capsules mostly emergent, oblong to cylindric.
Capsules somewhat ribbed when dry but the exothecial cells slightly or not at all differentiated along the ribs; segments of the inner peristome erose. 11. *O. pycnophyllum.*
Capsules strongly ribbed when dry, the exothecial cells plainly differentiated; segments not erose. 10. *O. affine.*

KEY B

Plants aquatic or growing on wet rocks; leaves broadly obtuse.
Many leaves denticulate at the apex; leaf-cells 10–12 μ in diameter. 21. *O. rivulare.*
Leaves entire or rarely with a single apiculus. 22. *O. Sprucei.*
Plants not aquatic, mostly xerophytic; leaf-apices various.
Plants growing on rocks; peristome-teeth mostly erect to spreading when dry.
Capsules plainly exserted, wet or dry. 24. *O. anomalum.*
Capsules immersed to emergent.
Leaves oblong to oblong-lanceolate, rounded-obtuse. 31. *O. Jamesianum.*
Leaves oblong-lanceolate to lanceolate, broadly to slenderly acute.
Peristome-teeth striate, at least in the upper portion.
Peristome-teeth papillose at the base, vertically striate at the apex (nearly smooth to papillose in vars.). 30. *O. alpestre.*
Peristome-teeth striate throughout.
Peristome single; most leaves obtusely acute.
Upper part of the leaves bistratose; capsules mostly oblong. 29. *O. Hallii.*
Upper part of the leaves unistratose; capsules mostly subglobose. 25. *O. cupulatum.*
Peristome double; most leaves slenderly acute. 26. *O. urnigerum.*
Peristome-teeth papillose (forms of *O. alpestre* may be sought here).
Capsules gradually tapering to the seta. 27. *O. strangulatum.*
Capsules abruptly narrowed to the seta.
Leaves, especially the upper, denticulate and hyaline-apiculate near the apex. 39. *O. Garrettii.*
Leaves entire, none hyaline-apiculate.
Leaves broadly lanceolate, 3–4 mm. long; calyptra naked; very rare, in the western U. S. only. 23. *O. euryphyllum.*
Leaves narrowly lanceolate, mostly less than 2.5 mm. long; calyptra with a few hairs. 28. *O. Lescurii.*
Plants growing on trees; peristome-teeth mostly reflexed when dry.
Capsules smooth or slightly wrinkled when old. 40. *O. pusillum.*
Capsules strongly ribbed, especially when old.
Leaves imbricate when dry, not noticeably contorted nor crisped.
Capsules exserted or nearly so. 32. *O. tenellum* var. *Coulteri.*
Capsules emersed to emergent.
Upper and perichaetial leaves more or less denticulate. 34. *O. Bartrami.*
Leaves entire.
Stomata in the neck of the capsule. 32. *O. tenellum.*
Stomata in the walls of the spore-sac.
Stomata having guard-cells largely exposed.
Leaves broadly long-decurrent; leaf-cells collenchymatous, the basal with nodose walls. 33. *O. malacophyllum.*
Leaves not decurrent; leaf-cells not collenchymatous nor nodose. 35. *O. pallens* var. *parvum.*

Stomata having guard-cells mostly hidden.
Leaves mostly obtuse.
Capsules straw-colored, only slightly contracted below the mouth when dry and empty. 37. *O. ohioense.*
Capsules dark-colored, strongly plicate and contracted below the mouth when dry and empty. 36. *O. stellatum.*
Leaves mostly acute.
Leaf-cells 10–12 μ in diameter, thick-walled; peristome-teeth striate above. 30. *O. alpestre.*
Leaf-cells 12–16 μ in diameter, thin-walled; peristome-teeth papillose throughout. 38. *O. pumilum.*
Leaves contorted to crisped when dry.
Capsules immersed; peristome-teeth dark orange. 41. *O. pulchellum.*
Capsules exserted or nearly so; peristome-teeth pale. 42. *O. consimile.*

Section 1. Gymnoporus (Lindb.) Grout, comb. nov. [*Dorcadion.* B] *Gymnoporus* Lindb. Musci Scand. 28. 1879. Stomata superficial (phaneropore).

Subsection 1. Rupestria (Venturi) Grout, stat. nov. Sect. *Orthotricha rupestria* Venturi in Husnot, Musc. Gall. 155. 1887. Leaf-margins strongly revolute nearly to the apex (except in *O. Bolanderi*); monoicous (except *O. Lyellii*); peristome well developed and the segments rarely lacking.

1. Orthotrichum rupestre Schleich. Crypt. Helvet. III. *24.* 1806.

Orthotrichum Sturmii Hoppe & Hornsch. Flora 1: 341. 1818. (Nomen nudum.)
Orthotrichum rupincola sensu Hook. in Drummond, Musci Am. *156.* 1828. Not *O. rupincola* Funck, 1820.

Plants in more or less dense tufts or cushions, olive-green above, brown to almost black below, rather stiff when dry; stems erect, 3–5 cm. long, or ascending and reaching 10 cm., more or less branched; leaves lanceolate, tapering to a narrowly obtuse or rarely acute apex, reaching 5 mm. in length, spreading to recurved when moist, keeled, the margins strongly recurved to near the apex; costa nearly or quite reaching the apex; median leaf-cells thick-walled, irregular or rounded above, 8–12 μ in diameter, 1–2 times as long as broad, mostly unistratose, sometimes partially bistratose (or in forms partly in three layers), papillose, the papillae sometimes with two points; basal cells smooth, rectangular, linear in some of the upper leaves, 2–6 times as long as broad, the cell walls often more or less nodose and occasionally nearly as wide as the lumen, a small area of quadrate cells at the basal angles; autoicous; antheridial buds on axillary branches near the archegonial; capsules immersed to emergent, oblong to ovoid, light brown or yellowish, the urn 1.75–2.5 mm. long, the neck typically tapering but often short or almost wanting, scarcely contracted below the mouth when dry and empty except when very old, with 8 more or less conspicuous ridges when dry and empty, rarely with faint intermediate folds; calyptra hairy, with long spinulose hairs, plicate, covering most of the capsule; exothecial cells little differentiated, rather long; stomata superficial, usually near the base of the spore-sac, the bordering cells not radiating; annulus double, persistent, of two rows of cells; operculum rounded-conic, apiculate to short-rostrate; peristome-teeth 16, erect or spreading, at first often united in pairs, quite variable, solid or more or less perforate along the median line, smooth to faintly papillose, sometimes with faint sinuous lines, the segments well developed, of two rows of cells, to short and rudimentary or even wanting; spores ± 15 μ in diameter, papillose-roughened, maturing in spring.

TYPE LOCALITY: The Tyrol.

DISTRIBUTION: On rocks and ledges containing little or no lime, in subalpine habitats; the Rocky Mountains and westward, north to British Columbia, south to Texas; also in Europe, Asia, and northern Africa.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 217;* Braithw. Brit. Moss-Fl. 2: *pl. 55B;* Husnot, Musc. Gall. *pl. 44.*

EXSICCATI: J. A. Allen, Mosses Cascade Mts. *40, 41;* Holz. Musci Acroc. Bor. Am. *314;* Grout, N. Am. Musci Perf. *224.*

NOTE: Exceedingly variable in the characters that have been used to distinguish forms raised to specific rank by various authors. See Grout, Moss Fl. N. Am. 2: 110.

In young leaves the basal cells are mostly rectangular, 2–4 times as long as broad, scarcely incrassate. In older leaves the cell walls sometimes become almost as thick as the lumen is wide and often strongly nodose. The size of the leaf-papillae varies greatly but as a rule they are larger

and more conspicuous in American plants. It may be that *O. rupestre* as here treated is a composite species, but it seems useless to segregate species from our forms, which are based only on one or two variable and inconstant characters.

Orthotrichum rupestre var. globosum (Lesq.) Grout, Moss Fl. N. Am. **2**: 110. 1935. *O. texanum* var. *B. globosum* Lesq. Mem. Calif. Acad. 1[1]: 17. 1868. Calyptra naked or with very few short and nearly smooth hairs; capsule globose to short-pyriform, completely immersed. TYPE LOCALITY: Nevada Falls, Yosemite Park, California. DISTRIBUTION: West of the Rocky Mountains; rare. EXSICCATI: Holz. Musci Acroc. Bor. Am. *288, 314* (in part, as *O. Bolanderi*). NOTE: Mrs. Britton wrote as follows (Bull. Torrey Club **21**: 140. 1894): "We have a fragment of this variety from the type specimen, and have examined the capsules. They are short, immersed or only partly exserted, globose pyriform, with a tapering neck, peristome single, teeth pale, smooth or with faint traces of thickening ridges as in *O. bullatum*, but not papillose."

Orthotrichum rupestre var. MacFaddenae (R. S. Williams) Grout, Moss Fl. N. Am. **2**: 111. 1935. *Orthotrichum MacFaddenae* R. S. Williams, Bryologist **31**: 52. 1928. Leaves 3–4 mm. long; basal cells oblong to linear-flexuous, very incrassate with nodose walls; capsules slightly emergent when dry, the perichaetial leaves reaching slightly beyond when moist, oblong to oblong-ovoid, light-colored, very slightly or not at all ribbed until old; exothecial cells not clearly differentiated; peristome-teeth smooth in the type, slightly papillose in similar forms. TYPE LOCALITY: On rocks, British Columbia. DISTRIBUTION: British Columbia and Washington; Flat Top Mountain, Rocky Mountain Park, Colorado, alt. 12,000 feet. ILLUSTRATION: Bryologist **31**: *pl. 5*. EXSICCATI: Holz. Musci Acroc. Bor. Am. *368* (as *O. Douglasii;* in some sets this contains a form of *O. affine*). NOTE: Very near var. *ovatum* Venturi in Husnot, Musc. Gall. 155, if not the same. The light-colored, slightly striate capsules are very striking.

2. **Orthotrichum texanum** Sull. in Sull. & Lesq. Musci Bor. Am. *122*. 1856.

Orthotrichum bullatum C. Müll. Flora **70**: 223. 1887. (Type seen.)

Resembling *O. rupestre* and easily confused with it; capsules smooth or somewhat wrinkled; exothecial cells thin-walled and short, scarcely differentiated; peristome-teeth roughened with coarse irregular projections which are neither papillae nor striae, more or less perforate above, the segments poorly developed or lacking.

TYPE LOCALITY: Texas (*Wright*).

DISTRIBUTION: Apparently fairly common in the Rocky Mountain region; Texas to British Columbia.

ILLUSTRATION: Grout, Moss Fl. N. Am. **2**: *pl. 46B*.

EXSICCATI: Sull. & Lesq. Musci Bor. Am. *122;* Grout, N. Am. Musci Perf. *303*.

NOTE: Sull. & Lesq. Musci Bor. Am. *122* from Texas (*Wright*) is clearly the type, the capsule being smooth as described on the label. Musci Bor. Am. ed. 2, *187* is not the same, since it has smooth peristome-teeth; its leaves are rather broader and more obtuse than the general run of *O. rupestre,* to which it seems to belong. Sull. Ic. Musc. *pl. 34* and accompanying text seem to fit the latter specimen.

The best-developed form of *O. texanum* seems to be found in the Rocky Mountains of Colorado; the teeth are perforate and very rough; the leaves are very strongly papillose. From *O. rupestre* var. *MacFaddenae* it differs chiefly in the rough peristome-teeth; from *O. laevigatum* in the less exserted capsules, which are more wrinkled when dry and old, the rough peristome-teeth, and the more narrowly acuminate leaves.

3. **Orthotrichum Macouni** Aust. Bull. Torrey Club 6: 343. 1879.

Orthotrichum stenocarpum Venturi; Röll, Bot. Centr. **44**: 389. 1890. Not *O. stenocarpon* Brid. 1826.
Orthotrichum Schlotthaueri Venturi; Röll, Bot. Centr. **44**: 390. 1890.*

Plants in dense, robust tufts, olive-green above, brownish below; stems about 1–3 cm. long, sparingly branched; leaves loosely imbricate when dry, erect-spreading when moist, lanceolate to ovate-lanceolate, very slenderly acute at the apex, reaching 4 mm. in length; costa subpercurrent; otherwise much as in *O. rupestre;* autoicous; seta 2–4 mm. long; capsules exserted, light brown to straw-color, cylindric when dry, smooth or slightly ribbed when very old, oblong to ovoid when moist, the neck moderately long, wrinkled and twisted when dry, the urn 2–2.5 mm. long; calyptra hairy, plicate; stomata superficial, few; exothecial cells much as in *O. laevigatum*, long, narrow, little differentiated, their longitudinal walls incrassate; annulus much as in *O. laevigatum* except that the cells are apparently longer; operculum short-rostrate; peristome-teeth 16, sometimes united in pairs at first, light-colored, coarsely papillose, sometimes transversely striate at the base, the articulations fairly prominent, the segments 8, narrow, shorter than the teeth, smooth or nearly so; spores 12–15 μ in diameter, maturing in summer.

* See Bull. Torrey Club 21: 144, 145. 1894.

TYPE LOCALITY: On rocks, Cascade Mountains, British Columbia (*Macoun*).
DISTRIBUTION: On rocks; Alaska to Washington and Idaho; Montana; Utah; Newfoundland (*Waghorne*).
ILLUSTRATION: Grout, Moss Fl. N. Am. **2**: *pl. 46A*.
EXSICCATI: Macoun, Can. Musci *454;* Holz. Musci Acroc. Bor. Am. *212* (as *O. laevigatum*); Grout, N. Am. Musci Perf. *456*.
NOTE: Distinguished from *O. rupestre* by the slender-pointed leaves. Through var. *lonchothecium* it passes into *O. laevigatum*. The cotype of *O. Schlotthaueri* from Sun River Canyon, Montana (*Williams*) cannot be distinguished from *O. Macouni*, the capsules of which are often slightly ribbed when dry and old.

Orthotrichum Macouni var. **lonchothecium** (C. Müll. & Kindb.) Grout, Moss Fl. N. Am. **2**: 112. 1935. *Orthotrichum lonchothecium* C. Müll. & Kindb. in Macoun, Cat. Can. Pl. **6**: 90. 1892. Leaves rather blunt, as in *O. rupestre*. TYPE LOCALITY: Deer Park, Lower Arrow Lake, Columbia River, British Columbia (*Macoun;* cotype seen). DISTRIBUTION: British Columbia; Colorado. EXSICCATI: Macoun, Can. Musci *497* (type). NOTE: Distinguished from *O. laevigatum* by the more slenderly pointed leaves and the elongate exothecial cells; the peristomes are similar.

4. Orthotrichum Roellii Venturi; Röll, Bot. Centr. **44**: 390. 1890.

Plants closely cespitose, about 2 cm. high, freely divided; leaves broadly lanceolate to ovate-lanceolate, generally rather broadly acute, 2.5–3.5 mm. long, loosely appressed-imbricate when dry, strongly papillose except at the base, the margins strongly revolute to near the apex; costa strong, reaching into the apex; upper leaf-cells 7–12 μ in diameter, rounded, thick-walled, dense, isodiametric to oval, the basal quadrate to rectangular or oblong, seldom much more than twice as long as broad, except close to the base of the costa; autoicous; seta 1–2 mm. long; capsules exserted, smooth or lightly plicate when dry and empty, the neck long and tapering, the urn about as long as the seta; calyptra plicate, hairy; stomata superficial, scattered in the middle portion of the capsule, the surrounding cells shorter but not radiating; exothecial cells little differentiated along the folds; annulus present, with 4–6 rows of small, rounded, thick-walled cells below it; operculum conic-rostrate; peristome double, the teeth 16, more or less closely united in pairs, erect when dry, striate rather than papillose, the segments slender, nearly as long as the teeth, of two rows of rather irregular cells, smooth; spores about 15 μ in diameter, very finely papillose, maturing in spring.

TYPE LOCALITY: On rocks, Thorp, near Ellensburgh, Washington (*Röll*).
DISTRIBUTION: On rocks; British Columbia, Washington, and California.
ILLUSTRATION: Grout, Moss Fl. N. Am. **2**: *pl. 46C*.
EXSICCATI: Holz. Musci Acroc. Bor. Am. *660* (as *O. Schlotthaueri*).
NOTE: The leaves are much like those of *O. rupestre*, except for the shorter basal cells. The exserted, nearly smooth capsules are much like those of *O. Macouni*. The striate teeth distinguish *O. Roellii* from both of these.

5. Orthotrichum laevigatum J. E. Zett. Bull. Soc. Bot. Fr. **9**: 287. 1862.

Orthotrichum Douglasii Duby, Mém. Soc. Phys. Hist. Nat. Genève **19**: 293. 1868. (Type seen.)
Orthotrichum rhabdophorum Venturi; Röll, Bot. Centr. **44**: 418. 1890.

Plants dark brownish-green almost to the tips, 5–25 mm. high, more or less branched above, growing rather loose tufts; leaves erect-open when moist, broadly lanceolate to ovate-lanceolate, narrowly obtuse, 2–4 mm. long, when young sometimes acute, the margins revolute nearly to the apex; costa stout, mostly dorsal, extending nearly or quite to the apex; upper leaf-cells dense, irregular, rounded, nearly isodiametric, incrassate, papillose (the papillae * simple, bifid, or trifid, strongly salient), 10–12 μ in diameter, rarely in two layers above, the basal cells oblong to rectangular, translucent but often somewhat colored, their walls becoming thickened and often somewhat nodose when old, 9–15 μ wide, 2–4 times as long near the costa, the marginal cells shorter, subquadrate; autoicous; antheridial buds axillary; seta reaching 2–4 mm. long; capsules exserted, about one-half to three-fourths the length of the seta, ovoid to oblong-ovoid, cylindric when dry and empty, wrinkled when very old, otherwise smooth or nearly so except at the short or rather long neck; calyptra hairy, reaching to the mouth of the capsule; stomata superficial, few, in the lower half of the capsule; bordering cells shorter but not

* On young leaves the papillae seem very large and prominent, but on most of the older leaves they seem lower and rounded; in any case the papillae vary greatly on leaves of the same plant.

radiating; annulus persistent, with 4–6 rows of small thick-walled cells below it gradually merging into the slightly differentiated (i.e. nearly uniform all around), oblong to rectangular exothecial cells; operculum short-rostrate; peristome-teeth erect * or inclined inward, 16, united in pairs at first, sometimes perforate above, the articulations strongly marked, papillose, the segments varying from well developed to almost lacking; spores 10–15 μ in diameter, lightly papillose, maturing in early spring.

TYPE LOCALITY: Near Rodsheim, Norway.
DISTRIBUTION: On rocks; British Columbia to California and Nevada; Idaho; Wyoming; Utah.
ILLUSTRATIONS: Husnot, Musc. Gall. *pl. 44;* Schimp. Musci Eur. Novi (1–2:) Orthotr. *pl. 2;* Mém. Soc. Phys. Hist. Nat. Genève 19: *pl. 1, f. 2.*

Orthotrichum laevigatum var. **Kingianum** (Lesq.) Grout, Moss Fl. N. Am. 2: 113. 1935. *Orthotrichum Kingianum* Lesq. Mem. Calif. Acad. 1[1]: 18. 1868. Costa usually ending well below the apex of the leaf; upper leaf-cells reaching 15 μ in diameter, usually smaller; capsules longer and narrower, pyriform when moist, the neck long; articulations of the peristome-teeth indistinct, the segments shorter than the teeth, of two rows of cells. TYPE LOCALITY: Falls of the Yosemite, California (*Bolander*, type seen). DISTRIBUTION: Idaho and California. ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 55.* NOTE: Doubtfully worthy of even varietal rank. *O. laevigatum,* like *O. rupestre,* varies greatly, but the bluntish leaves, the protruding sharp papillae, and the fully exserted smooth capsule with superficial stomata can usually be depended upon. *O. rhabdophorum* Venturi is a form with capsules plicate when old; also the capsules are long-necked. Norwegian specimens from Hagen show these characters.

6. **Orthotrichum Bolanderi** Sull. Ic. Musc. Suppl. 64. 1874.

Plants almost black throughout, reaching 3.5 cm. in length, more or less branched above; leaves closely appressed-imbricate when dry, lanceolate, often ovate at the base, ± 3 mm. long, broadly keeled, when moist plane in the upper half and almost opaque owing to a double layer of rounded, incrassate, papillose cells 7–10 μ in diameter, the margins narrowly reflexed when dry; costa stout, vanishing in the apex; median basal leaf-cells rectangular, 2–4 times as long as broad, the marginal shorter; autoicous; seta about 1 mm. long; capsules emergent, more or less 8-ribbed when dry and empty, oblong-ovoid, the neck about 2 mm. long; calyptra hairy; stomata superficial; annulus present; operculum conic-apiculate; peristome-teeth 16, united in pairs, strongly papillose, the segments linear, nearly as long as the teeth, of two rows of cells, somewhat papillose; spores ± 20 μ in diameter, maturing in early spring.

TYPE LOCALITY: On rocks, California.
DISTRIBUTION: On rocks; southern California.
ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 46.*
EXSICCATI: Holz. Musci Acroc. Bor. Am. *288* (some sets are not this species; that at the U. S. National Museum is).
NOTE: Seemingly the peristome-teeth may be incurved or recurved according to conditions little understood, perhaps age; one capsule had teeth in both positions; the normal condition would seem to be reflexed or recurved. I have observed the same thing in *O. affine.* As Sullivant remarks, this is a fine and very distinct species, but the most evident distinction is in the leaves and not in the capsule. When the leaves are mounted they lie almost flat on the slide. That Venturi could place this as a variety of *O. rupestre* indicates poor judgment or else a lack of authentic material.

7. **Orthotrichum Holzingeri** Ren. & Card.; Holz. Contr. U. S. Nat. Herb. **3**: 270. 1895.

Plants large, reaching 2 cm. or more in height, in loose, wide cushions, very dark green; stems freely branching; leaves loosely imbricate when dry, oblong-lanceolate, narrowly obtuse, 2.5–3 mm. long, the lower much smaller; costa nearly or quite percurrent; upper leaf-cells irregularly rounded, nearly isodiametric, about 10 μ in diameter, dense, nearly or quite smooth, the basal rectangular, hyaline or slightly colored; autoicous; seta 3 mm. long; capsules long-exserted, oblong-cylindric, 8-ribbed when dry, about 2.5 mm. long, the long neck gradually narrowed to the seta; calyptra smooth or hairy; stomata superficial, in the lower part of the spore-sac, the surrounding cells radiating; exothecial cells scarcely differentiated; annulus present, with 6–8 rows of small rounded incrassate cells below it; peristome-teeth 16, erect

* Venturi (in Husnot, Musc. Gall. 158. 1887) stated that the teeth are erect in the type; later (Hedwigia 32: 270. 1893) he said (as was stated also by Schimper) that they are reflexed as in *O. speciosum.* In American plants referred to this species they are erect, also in specimens from Norway.

when dry, smooth, the preperistome very marked, reaching 3–4 articulations high, often double at the base and fragmentary to the middle of the teeth, segments apparently wanting (but the capsules seen were old and deoperculate).

TYPE LOCALITY: Lewiston, Idaho (*Sandberg*).
DISTRIBUTION: Apparently on soil; Idaho; Mt. Hood, Oregon.
ILLUSTRATION: Grout, Moss Fl. N. Am. 2: *pl. 48A*.
NOTE: This might pass for *O. laevigatum* except for the plicate capsules and strongly developed preperistome. Cardot states that the calyptra is naked in the type but that in specimens from Mt. Hood it is hairy; he does not mention the preperistome.

8. **Orthotrichum fenestratum** Card. & Thér. Proc. Wash. Acad. 4: 310. 1902.

Laxly pulvinate, dark green, blackish below; stems much divided, 1–1.5 cm. long; leaves erect, imbricate when dry, scarcely spreading when moist, the upper larger, lanceolate to ovate-lanceolate, the margins entire, revolute nearly to the apex; costa narrow, vanishing below the apex; lower leaf-cells subhyaline, rectangular, 2–4 times as long as broad, shorter toward the margins, their walls nodose, the median and upper leaf-cells irregular, round or short-ovate, 9–12 μ in diameter, their walls thick; monoicous; male flowers sessile under the female; seta 1–2 mm. long; capsules exserted, pale yellow, ovoid-pyriform, subglobose when dry and abruptly contracted at the base, when moist gradually narrowed into a long, slender neck, smooth or nearly so, including the neck 3 mm. long and half as thick; calyptra conic-campanulate, plicate, bearing a few whitish hairs; vaginula naked; stomata superficial; exothecial cells only slightly differentiated; operculum slightly convex, rostrate; peristome seemingly smooth, the teeth 16, united in pairs, pale yellow, granulose, erect or spreading when dry, cancellate and cribrose-perforate in the upper part.

TYPE LOCALITY: St. Paul Island, Bering Sea (*Macoun*).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATIONS: Grout, Moss Fl. N. Am. 2: *pl. 48C*; Proc. Wash. Acad. 4: *pl. 16, f. 2a–n*.
NOTE: "This moss was distributed as *O. anomalum* Hedw., but it bears no resemblance to that species. It is allied to *O. cribrosum* C. Müll. from the Chukchi peninsula, Siberia, chiefly by the shape of the capsule and the structure of the peristomial teeth, but it differs from it by its larger size and the leaf-areolation, composed of less incrassate and less papillose cells" (Proc. Wash. Acad. 4: 311). The pale straw-colored, goblet-shaped, exserted capsules and the perforate peristome-teeth with very thick, dark projections at the joints, but irregularly placed, are very striking and distinctive.

9. **Orthotrichum cancellatum** Card. & Thér. Univ. Calif. Publ. Bot. 2: 299. 1906.

Rather densely pulvinate; stems branching, 1–1.5 cm. high; leaves imbricate when dry, erect-spreading when moist, the median 1.5–1.7 mm. long, 0.4–0.5 mm. broad, acute or mucronate, the upper larger, lanceolate or ovate-lanceolate, the margins entire, revolute nearly to the apex; costa narrow, vanishing below the apex, 50–65 μ thick at the base; lower leaf-cells hyaline or pellucid, rectangular, shorter toward the margins, subquadrate, smooth, the median and upper leaf-cells unequal, subcircular to ovate, chlorophyllose, papillose, 12–18 μ in diameter, their walls thick; monoicous; male flowers under the female; perigonial leaves short, ovate, obtuse, ecostate, entire; seta 0.5 mm. long; capsules immersed, ovoid-pyriform, when dry 8-ribbed, contracted beneath the mouth, when moist gradually attenuate to the seta by the neck, without the operculum 1.2 × 0.9 mm.; calyptra conic, plicate, brown at the apex, bearing a few white hairs; vaginula naked; stomata superficial; exothecial cells differentiated; peristome double, the outer of 16 teeth united in pairs, or sometimes separate, reflexed when dry, granulose, perforate and appendiculate-cancellate in the upper part, the segments shorter, granulose; spores very large, 30–35 μ in diameter, papillose.

TYPE LOCALITY: Cape Dyer, Norton Sound (type in herb. Thériot and a portion kindly sent by M. Thériot in herb. Duke Univ.).
DISTRIBUTION: Alaska; Quebec (*Lepage*).
ILLUSTRATION: Univ. Calif. Publ. Bot. 2: *pl. 27, f. 1a–n*.
NOTE: "By the elegant structure of the peristomial teeth, this interesting species comes very near *O. fenestratum* Card. et Thér., but differs from it by its smaller size, shorter stems, shorter and more papillose leaves, and the capsule immersed, sulcate in dry state" (Univ. Calif. Publ. Bot. 2: 299). In the specimens sent me the capsules were almost exserted, all except the lower neck being

above the perichaetial leaves; the leaves reached more than 2 mm. in length and were almost as strongly papillose as in *O. alpestre*. The markings on the teeth are coarse, elongated, and irregular, but too short to be called striae.

10. **Orthotrichum affine** Brid. Musc. Recent. 2^2: 22. 1801.

Orthotrichum affine f. *obtusa* Grout, Moss Fl. N. Am. **2**: 115. 1935.

Plants in rather small, loose tufts, dull green, 1–2 cm. high, branching freely above; leaves more or less closely imbricate when dry, oblong-lanceolate, acute to subacute, 3–4 mm. long, the margins recurved to the apex; costa nearly or quite percurrent; upper leaf-cells irregularly rounded, isodiametric to slightly elongate, papillose, 12–15 μ in diameter, the median basal cells smooth, elongate, subrectangular, rather thin-walled, subhyaline, the walls becoming slightly thickened and nodose with age, the marginal cells shorter; perichaetial leaves more or less obtuse; autoicous; seta about half the length of the capsule; capsules emergent to almost exserted, oblong-cylindric, strongly 8-ribbed and shrunken but not urceolate when dry and empty, the neck long and tapering; calyptra slightly hairy; stomata superficial, near the middle of the spore-sac; exothecial cells of the ribs strongly differentiated; annulus present, with 4 or 5 rows of small, thick-walled, transversely elongate cells below it; operculum conic-rostellate; peristome-teeth 16, united in pairs, reflexed when dry, trabeculate and perforate above, papillose, the papillae sometimes arranged in lines, the segments 8, of two rows of cells, papillose, slender; spores 15–20 μ in diameter, maturing in early summer.

TYPE LOCALITY: Germany.

DISTRIBUTION: On trees, rarely on rocks; the Rocky Mountains and westward; Europe, Asia, and Africa; apparently rare in most parts of North America, frequent in Utah.

ILLUSTRATIONS: Braithw. Brit. Moss-Fl. **2**: *pl. 55D;* B.S.G. Bryol. Eur. *pl. 216;* Husnot, Musc. Gall. *pl. 47*.

EXSICCATI: Holz. Musci Acroc. Bor. Am. *366* (as *O. sordidum*), *368* (as *O. Douglasii*); Grout N. Am. Musci Perf. *99* (as *O. sordidum*).

NOTE: Often confused with *O. speciosum*, which has fully exserted capsules which are nearly smooth until empty, and exothecial cells only slightly differentiated. *O. Lyellii* has much more slenderly pointed leaves, which are much more strongly papillose. See Grout, Moss Fl. N. Am. **2**: 115.

11. **Orthotrichum pycnophyllum** Schimp.; C. Müll. Syn. **1**: 709. 1849.

Orthotrichum recurvans Schimp.; C. Müll. Syn. **1**: 709. 1849.
Orthotrichum Lozanoi Card. Rev. Bryol. **36**: 107. 1909.

Plants small; stems slender, 1–2 cm. high, sparingly branched; leaves erect when dry, spreading or recurved when moist, lanceolate, broadly acute to acuminate, 2–3 mm. long, the margins recurved; costa ending below the apex to shortly excurrent; upper leaf-cells irregular, rounded, nearly isodiametric, with 2–3 minute papillae, 6–8 μ in diameter, the basal clear, smooth, elongate, linear-oblong, short-rectangular at the basal angles; autoicous; antheridia in small axillary buds; seta 3–4 mm. long, or sometimes shorter and the capsule only partially exserted; capsules ovoid, 1.5–2 mm. long, ribbed when ripe and dry, the walls thin, the cells of the ribs only slightly differentiated, the neck rather short; calyptra more or less hairy; stomata superficial, in two rows around the lower middle of the capsule, small and usually bordered by short radiating cells; operculum rostrate, bordered with red; peristome double, the teeth 16, densely and minutely papillose, more or less united in pairs, the segments of the endostome 16, irregular on the edges (erose), recalling those of *O. striatum* but narrower and coarsely papillose; spores large, 25–35 μ in diameter, papillose.

TYPE LOCALITY: Peak of Orizaba, Vera Cruz (*Liebmann*).

DISTRIBUTION: Mexico (*Pringle 10519*, in part, as *O. Lozanoi*, *10597*, as *O. recurvans*; *Barnes & Land 388*, *451*, as *O. recurvans*, *400*, as *O. Lozanoi*).

NOTE: In Smithson. Misc. Coll. **81**: 15, Thériot says of this species: "Brother Amable's material is plentiful, with well-fruited specimens, consequently I was able . . . to ascertain the wide variability of this species. . . . in the same tuft some plants have immersed capsules and others show them more or less exserted; sometimes the ripe capsules are entirely smooth and sometimes a little costate; the segments of the inner peristome may be nearly entire or more or less erose; . . . ."

The types of both of Müller's species cited above came from the same collection of Liebmann and were intermingled.

Orthotrichum pycnophyllum var. **lutescens** (Card.) Grout, comb. nov. ***Orthotrichum Lozanoi*** **var.** ***lutescens*** Card, Rev. Bryol. 36: 107. 1909. Plants 4–5 cm. high, light yellowish-green, in loose tufts; stems branching; leaves erect-appressed when dry, spreading when moist, lanceolate, acuminate, carinate, 3–6 mm. long, the margins revolute, entire or papillose-crenulate at the apex; costa ending in the subulate point, or excurrent in the upper and perichaetial leaves, papillose on the back; lower leaf-cells elongate with thick, sinuous walls, the upper shorter, irregular, mostly longer than broad, bearing sharp, double papillae, up to 12 μ long, with narrow and irregular lumina; autoicous; antheridia below the perichaetial leaves, which are longer with a more hyaline base; seta about 1 mm. long, several from the same plant on short lateral branches; capsules ovoid-cylindric, 1.5–2 mm. long, striate, becoming sulcate with age; calyptra and vaginula hairy with long, jointed, papillose hairs; stomata superficial, in two rows around the middle of the capsule, often not bordered by radiating cells; operculum rostrate, bordered by orange cells; peristome-teeth in pairs, reflexed, pale, minutely and densely papillose; spores 24–37 μ in diameter, rough. TYPE LOCALITY: Mountains near Monterrey, Nuevo León (*Pringle 731*). DISTRIBUTION: Known only from the type locality.

12. **Orthotrichum sordidum** Sull. & Lesq.; Aust. Musci App. 30. 1870.

An eastern species closely related to *O. affine;* leaves abruptly acute; seta less than 0.5 mm. long; capsules nearly or quite immersed, ovoid-pyriform, the neck as long as the spore-case, light yellow, rather lightly ribbed, the urn 1.2–1.6 mm. long; exothecial cells only moderately differentiated; peristome-teeth sometimes remaining erect for a considerable time.

TYPE LOCALITY: Cambridge, Massachusetts.
DISTRIBUTION: Common on the bark of trees; northeastern United States and southeastern Canada, south to New Jersey.
ILLUSTRATIONS: Sull. Ic. Musc. Suppl. *pl. 49*.
EXSICCATI: Aust. Musci App. *168* (some specimens mixed with other species); Grout, N. Am. Musci Perf. *341*.
NOTE: See Grout, Moss Fl. N. Am. 2: 115.

13. **Orthotrichum microblepharum** Schimp. Musci Eur. Novi (1–2:) Orthotr. 2. 1864.

Orthotrichum Blyttii Schimp. Musci Eur. Novi (1–2:) Orthotr. 3. 1864.
Orthotrichum arcticum Schimp. Musci Eur. Novi (1–2:) Orthotr. 5. 1864.
Orthotrichum groenlandicum Berggr. Sv. Vet.-Akad. Handl. II. 13[8]: 23. 1875.
Orthotrichum idahense Card. & Thér. Bot. Gaz. 30: 19. 1900.

Plants in dense, wide tufts, brownish below, olive above, 1–3 cm. high; leaves much as in *O. laevigatum*, appressed-imbricate when dry, ovate-lanceolate, obtuse to broadly acute, the margins recurved almost to the apex; upper leaf-cells rounded, densely papillose with one or more simple or forked papillae which are variable on different leaves of the same plant, sometimes extending nearly to the base along the margins, the basal cells rectangular and usually smooth; autoicous; seta 1–2 mm. long; capsules nearly or entirely exserted, pyriform, when dry urceolate and abruptly narrowed to the twisted neck, strongly plicate with 8 ribs, much like those of *Ulota crispa* var. *crispula;* calyptra hairy, covering the capsule; stomata superficial, mostly near the base of the spore-sac, often in groups of 2–5; annulus persistent, below it 5–9 rows of small, rounded, thick-walled cells; operculum conic-apiculate; peristome-teeth 16, united in pairs, finely and densely papillose, more or less trabeculate and perforate at the apex, closely reflexed when dry, sometimes dark orange, the segments 8, linear, shorter than the teeth, of 1 or 2 rows of cells, often poorly developed, usually slightly papillose; spores 16–21 μ in diameter, finely papillose, usually maturing in spring.

TYPE LOCALITY: Norway.
DISTRIBUTION: On rocks at high altitudes and latitudes; Greenland; Newfoundland (*Waghorne*); Labrador; Isles aux Coudres in the St. Lawrence River (*M.-Victorin*); Kodiak Island (*Macoun*); Pribiloff Islands; Unalaska (*Flett*); Nevada County, California (*Leiberg 5468, 5469, 5472, 5474*); on trees in the Lake Superior region and in Cook County, Minnesota.
ILLUSTRATIONS: Schimp. Musci Eur. Novi (1–2:) Orthotr. *pl. 3–5;* Bot. Gaz. 30: *pl. 5*.
EXSICCATI: Macoun, Can. Musci *122*.
NOTE: Specimens from the St. Lawrence River, the Lake Superior region, and Cook County, Minnesota, have dark orange peristome-teeth. See Grout, Moss Fl. N. Am. 2: 116 for further discussion of this species.

Orthotrichum microblepharum var. **praemorsum** (Venturi) Grout, comb. nov. ***Orthotrichum praemorsum*** Venturi; Röll, Bot. Centr. 44: 418. 1890. Differs from the typical form in the slender-pointed leaves and the emergent capsule on a shorter seta. TYPE LOCALITY: On rocks, Yellowstone

National Park, Wyoming (*Röll 1491;* a portion of the type is at the New York Botanical Garden).
DISTRIBUTION: Known only from the type locality.

14. **Orthotrichum speciosum** Nees in Sturm, Deuts. Fl. Crypt. **5**(17): 5. 1819.

Orthotrichum speciosum var. *polycarpum* Lesq. & James, Man. 169. 1884.
Orthotrichum Rauei Aust. Bull. Torrey Club **6**: 343. 1879.

Plants in tufts, loose to dense, green to yellow-green above, 1–4 cm. high, branching; leaves loosely imbricate when dry, oblong-lanceolate to elongate-lanceolate, acute to very slenderly acuminate, keeled, reaching 3–4 mm. long, the margins recurved nearly to the apex except in young or perichaetial leaves; costa nearly or quite percurrent; basal leaf-cells quadrate at the margins, near the costa long-rectangular, the longitudinal walls becoming very thick and nodose with age, gradually merging into the upper rounded or oblong incrassate cells, which are 12–15 μ in diameter (18–20 μ according to Limpricht), strongly papillose with one or more strong, sharp, simple or bifid papillae; autoicous; seta 1.5–2 mm. long; capsules greenish, changing to light yellow, nearly or quite exserted, with a long neck of thin tissue, cylindric to oblong-ovoid when dry, nearly smooth until empty, then slightly narrowed under the mouth and lightly plicate the whole length when old, the urn about 2 mm. long with 8 bands, clearly indicated by bands of differentiated exothecial cells with thicker walls; calyptra hairy; stomata superficial, surrounded by shorter cells; annulus present, below it 3–5 rows of small, incrassate, rounded cells; operculum conic with a beak equal to its diameter; peristome-teeth 8, geminate, rarely separating, strongly papillose, often perforate, when dry typically revolute with the tips touching the outer wall of the capsule, the segments 8, well developed, nearly as long as the teeth, rather irregular in outline, often appendiculate, of two rows of cells; spores 15–25 μ in diameter, papillose, usually maturing in early summer.

TYPE LOCALITY: Germany.
DISTRIBUTION: Mostly on trees, sometimes on non-calcareous rocks; California to Alaska; Europe; Asia; Africa.
ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 217;* Braithw. Brit. Moss-Fl. **2**: *pl. 56A;* Husnot, Musc. Gall. *pl. 46;* Sturm, Deuts. Fl. Crypt. **5**(17): *pl. 5.*
EXSICCATI: Holz. Musci Acroc. Bor. Am. *111, 494, 592* (as *O. affine*); Allen, Mosses Cascade Mts. *44;* Drummond, Musci Am. *158;* Grout, N. Am. Musci Perf. *453.*
NOTE: Forms agreeing with the European are more common in the Rocky Mountains and westward. In these the capsules are lightly 8-striate when old, dry, and empty, and the cells in the wrinkles are differentiated. This form is rare or absent in the eastern United States. Frequently the teeth do not become recurved until some time after the operculum falls.

Orthotrichum speciosum var. **Killiasii** (C. Müll.) Grout, Moss Fl. N. Am. **2**: 117. 1935. *Orthotrichum Killiasii* C. Müll. Bot. Zeit. **17**: 166. 1859. A depauperate alpine form growing on rocks in denser cushions, the leaves dense, appressed, much shorter and with very large, forked papillae; segments broader with rarely a trace of 8 intermediate ones. TYPE LOCALITY: Graubünden, Switzerland. DISTRIBUTION: Disco Island, Greenland; Europe.

Orthotrichum speciosum var. **Hainesiae** (Aust.) Paris, Index Bryol. 896. 1896. *Orthotrichum Hainesiae* Aust. Bull. Torrey Club **6**: 342. 1879. Plants dark and depauperate; leaves spreading; capsules smaller and less exserted; calyptra almost smooth. TYPE LOCALITY: On rocks in the Rocky Mountains. DISTRIBUTION: The Rocky Mountains.

15. **Orthotrichum elegans** Schwaegr.; Hook. & Grev. Edinb. Jour. Sci. **1**: 122. 1824.

Orthotrichum speciosum var. *Roellii* Venturi: Röll, Bot. Centr. **44**: 419. 1890.
Orthotrichum psilothecium C. Müll. & Kindb. in Macoun, Cat. Can. Pl. **6**: 91. 1892.

The eastern counterpart of the western *O. speciosum;* plants smaller than the latter, rarely much over 1 cm. in height, darker green; leaves less slenderly pointed, with very much smaller and usually simple papillae; capsules nearly or quite exserted, oblong-ovoid, smooth, nearly cylindric when dry, the urn about 2 mm. long; exothecial cells nearly uniform; peristome-teeth with up to 14 segments; spores maturing in summer.

TYPE LOCALITY: On trees, North America between lat. 54° and 64° (*Dr. Richardson*).
DISTRIBUTION: Common on trees; northern United States and southeastern Canada, mostly east of the Mississippi River; Minnesota.
ILLUSTRATIONS: Edinb. Jour. Sci. 1: *pl. 6;* Grout, Moss Fl. N. Am. 2: *pl. 50D.*
NOTE: See observations on this species in Grout, Moss Fl. N. Am. 2: 117.

16. **Orthotrichum Lyellii** Hook. & Tayl. Musc. Brit. 76. 1818.

Plants robust, 2–6 cm. high, brownish-green to olive-green above, brown below, in rather loose, soft tufts; stems erect to ascending, branched; leaves of European plants bearing numerous brown, septate brood-bodies, mostly rather rigid and closely imbricate, varying to loosely imbricate and almost crisped in a few instances, when moist widely spreading, narrowly long-lanceolate from an oblong base, more or less undulate near the apex, acute, 3–4 mm. long, the margins usually plane and somewhat irregular in outline above and often finely and sharply denticulate with large papillae, usually plane at the base and somewhat revolute for a varying distance in the widest part; leaf-cells typically papillose with large, salient, conical to linear papillae except near the insertion, the basal oblong-linear, smooth, usually incrassate, sometimes as thick-walled as the upper, gradually changing into the rounded or elliptic, strongly incrassate upper cells, 10–12 μ in diameter; papillae, at least in the lower portion of the leaf, occasionally bifid; dioicous; seta about 0.5 mm. long; capsules immersed to emergent, oblong-ovoid, the neck often as long as the urn proper, which is 1–2 mm. long, with 8 well marked ribs when dry; calyptra large, oblong-conic, hairy; exothecial cells well differentiated along the ribs; stomata superficial, very few, near the base of the spore-sac; annulus present; operculum conic-rostellate; peristome double, the teeth 16, slender, densely and finely papillose, revolute when dry, the segments large, of 2 rather irregular rows of cells, papillose, nearly as long as the teeth, easily broken; spores 25–35 μ in diameter, maturing from winter to early spring.

TYPE LOCALITY: Europe.

DISTRIBUTION: On trees; California; Europe; Asia; Africa.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 221;* Husnot, Musc. Gall. *pl. 46;* Braithw. Brit. Moss-Fl. 2: *pl. 56B;* Hook. & Tayl. Musc. Brit. *pl. 22.*

EXSICCATI: Baker, Pacif. Slope Bryoph. *354;* Howe, Musci Calif. *22, 53.*

NOTE: Most of the material labeled *O. Lyellii* from North America is var. *papillosum.* True *O. Lyellii* is rare in North America. I have examined dozens of specimens of this and its varieties and have found but one, *Abrams 3790,* California, in the U. S. National Museum, that had the characteristically abundant brood-bodies.

Orthotrichum Lyellii var. **papillosum** (Hampe) Lesq. & James, Man. 178. 1884. *Orthotrichum papillosum* Hampe, Linnaea **30**: 458. 1860. *Orthotrichum Menziesii* Hook.; Mitt. Jour. Linn. Soc. **8**: 24. 1864. *Orthotrichum Sullivanti* Aust. Bull. Torrey Club **6**: 343. 1879 (nomen nudum). *Orthotrichum strictum* Venturi: Röll, Bot. Centr. **44**: 419 [as "Subspecies des *O. Lyellii*"]. 1890. *Orthotrichum Lyellioides* Kindb. Rev. Bryol. **23**: 21. 1896. *Orthotrichum Lyellii* var. *Howei* Ren. & Card. Bot. Gaz. **30**: 20. 1900. Plants lighter-colored; stems less rigid; leaves with a much longer and more slender apex, reaching 5 mm. in length, rarely with brood-bodies; capsules usually more emergent, the seta longer, up to 1.5 mm. long, the neck shorter. TYPE LOCALITY: California. DISTRIBUTION: Common in the Rocky Mountains and westward; Texas (*Wright*). EXSICCATI: Holz. Musci Acroc. Bor. Am. *493;* Baker, Pacif. Slope Bryoph. *88.*

Orthotrichum Lyellii f. **Pringlei** (C. Müll.) Grout, Moss Fl. N. Am. 2: 118. 1935. *Orthotrichum Pringlei* C. Müll. Bull. Torrey Club **13**: 120. 1886. The extreme form of var. *papillosum;* leaves with long slender apices, at times almost filiform, contorted to crispate in the upper portions of the stems and branches when dry. TYPE LOCALITY: Coos River, Oregon. DISTRIBUTION: California to British Columbia; Mexico. EXSICCATI: Holz. Musci Acroc. Bot. Am. *189, 367;* Sull. & Lesq. Musci Bor. Am. ed. 2, *185;* Allen, Mosses Cascade Mts. *43.* NOTE: The nearly plane-margined leaves and the dioicous inflorescence easily distinguish all forms of this from related species. All sorts of variations and gradations are found between the typical *O. Lyellii* and f. *Pringlei.* North American plants as a rule have leaves broader at the base than the European, and the latter vary more in the direction of var. *papillosum* than the manuals indicate. A plant in the U. S. National Museum from St. Leonard's forest, England, has crispate leaves and as large papillae as any observed in American plants. The leaves of male plants appear to be more slender than those of female.

17. **Orthotrichum striatum** Hedw. Sp. Musc. 163. 1801.

Orthotrichum leiocarpum Bruch & Schimp. in B.S.G. Bryol. Eur. (2–3:) Orthotr. 28. 1837.

Plants in irregular and often rather loose tufts, deep green to yellowish-green above; stems erect to ascending, 1–5 cm. long, branching; leaves loosely imbricate when dry, long-lanceolate and slender-pointed, 3–4 mm. long, the margins recurved or revolute nearly to the often serrulate apex; costa extending nearly to the apex; leaf-cells unistratose, the median basal oblong to sublinear, more or less incrassate, the marginal subquadrate and the main body of cells irregularly rounded, elliptic to circular above, incrassate, bearing simple papillae; autoicous; seta very short; capsules immersed, smooth, brownish to straw-colored, oblong to ovoid, slightly contracted below the mouth when dry and empty but without traces of striae; calyptra straw-

colored, hairy; stomata superficial; annulus present; operculum conic, red at the margin; peristome-teeth 16, of many articulations, recurved when dry, densely and evenly papillose, the segments 16, nearly as long as the teeth, of two very irregular rows of cells, papillose, erect; spores about 25 μ in diameter, lightly papillose, maturing in early spring.

TYPE LOCALITY: Europe.

DISTRIBUTION: On the bark of trees; very rare in North America; Vancouver Island; Washington; Idaho; near Lake Superior and probably elsewhere; Mexico (*Barnes & Land 400*); South America; Europe; Asia; Africa.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 220;* Husnot, Musc. Gall. *pl. 45;* Braithw. Brit. Moss-Fl. 2: *pl. 56C.*

EXSICCATI: Sull. & Lesq. Musci Bor. Am. *121c;* ed. 2, *183;* Drummond, Musci Am. *154;* Aust. Musci App. *172;* Allen, Mosses Cascade Mts. *37* (as *O. laevigatum*).

Subsection 2. Obtusifolia (Venturi) Grout, stat. nov. Sect. *Orthotricha obtusifolia* Venturi in Husnot, Musc. Gall. 193. 1888. *Strömia* Hagen, Norske Vidensk. Selsk. Skr. 1907: 92, as genus. 1908. Leaves obtuse, the margins slightly recurved, plane, or involute; dioicous; calyptra naked; peristome present or wanting.

18. **Orthotrichum obtusifolium** Brid. Musc. Recent. 2^2: 23. 1801.

Plants in small, dense, irregular tufts, light green to yellow-green; stems ± 1 cm. high with few turgid branches above, occasionally with slender, sterile, small-leaved shoots; leaves closely imbricate when dry, widely spreading when moist, broadly ovate to oblong-lingulate, concave with the margins plane (rarely slightly incurved in the middle in western forms), mostly broadly obtuse at the apex (occasionally some of the leaves on a plant narrowly obtuse to subacute), reaching 2.5 mm. in length, entire except for the marginal papillae, decurrent; costa ending below the apex; brood-bodies commonly present and abundant; leaf-cells bearing on both sides, except near the base, large blunt papillae, double or single, the upper cells rounded, incrassate, about 12 μ wide and a little longer, at the base the marginal cells quadrate to short-rectangular, those near the costa elongate-rectangular; perichaetial leaves broader; dioicous; male plants smaller; capsules immersed, or in American forms emergent on a very short seta, ovoid to elongate-pyriform, the neck as long as the spore-case, when dry 8-ribbed and contracted under the mouth; calyptra bell-shaped, naked, rough at the apex; stomata superficial, very few; annulus present, below it 7 or 8 rows of very small, quadrate to transversely elongate cells; peristome double, the teeth 16, united in pairs except at the tips, densely and finely papillose, reflexed when dry, reddish, the segments 8, nearly as long as the teeth, of 2 rows of cells, rather wide; spores finely roughened, maturing in spring.

TYPE LOCALITY: Near Göttingen, Germany.

DISTRIBUTION: On the bark of trees; southern Canada across the continent, north to Alaska, south to Maryland and Arizona; Europe; Asia.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 208;* Braithw. Brit. Moss-Fl. 2: *pl. 55A;* Husnot, Musc. Gall. *pl. 52.*

EXSICCATI: Sull. & Lesq. Musci Bor. Am. *116;* Holz. Musci Acroc. Bor. Am. *594;* E. Bartr. Mosses So. Ariz. *152;* Aust. Musci App. *164;* Grout, N. Am. Musci Perf. *100.*

NOTE: Frequent in New England; does not fruit freely.

19. **Orthotrichum gymnostomum** Bruch; Brid. Bryol. Univ. 1: 782. 1872.

Plants in yellowish-green tufts, reddish-brown within; stems 0.5–1 cm. tall, erect, rigid, usually simple, sometimes with one or more clavate innovations; leaves when dry closely imbricate, when moist spreading, oblong-ovate, concave, carinate, broadly obtuse, 2–2.5 mm. long, the margins strongly involute except at the base, the apex often almost cymbiform; costa narrow, disappearing below the apex; middle basal leaf-cells broadly linear, quadrate at the basal angles, the upper oblong-rhomboidal, the apical oval or roundish, about 15 μ in diameter, each with one or two stout papillae; perichaetial leaves similar but longer, oblong-lanceolate, often plane at the apex; dioicous; male plants smaller, sometimes in separate tufts; seta very short; capsules immersed, oblong-ovate, oblong when dry and empty, rounded at the truncate base, the neck shorter than the spore-sac, the 8 ribs yellowish, each composed of 2–4 rows of thick-walled cells; calyptra plicate, conical, without hairs but rough and black at the apex;

only a few superficial stomata near the mouth of the capsule; operculum narrowly conical from a convex base; spores maturing in spring.

TYPE LOCALITY: Europe.
DISTRIBUTION: On aspens; Upper Sandy Point, Newfoundland (*Waghorne*); Europe; Japan.
ILLUSTRATIONS: Husnot, Musc. Gall. *pl. 52;* B.S.G. Bryol. Eur. *pl. 208*.

20. **Orthotrichum exiguum** Sull. Musci U. S. 33. 1856.

Plants small, less than 5 mm. high, dark green; leaves appressed when dry, oblong, the lower smaller and subacute, the upper and the perichaetial much larger and obtuse, reaching 1 mm. in length, the margins more or less reflexed, especially below; costa strong, reaching nearly or quite to the apex; upper leaf-cells rather irregularly rounded, isodiametric, 7–10 μ in diameter, very dense above, papillose-mammillose, the papillae nearly as large as the cell and sometimes slightly notched, the lower cells becoming gradually elongate and smooth toward the base, oblong-rectangular at the insertion; dioicous; seta very short; capsules nearly or quite immersed, oblong-ovoid with a short, broad neck, about 1 mm. long, obscurely ribbed when dry; calyptra nearly or quite naked; exothecial cells not differentiated; stomata on the neck, superficial; operculum hemispheric-apiculate; peristome-teeth united in pairs, irregularly substriate, the segments 8, broader than the paired teeth and nearly as long, punctate; spores maturing in spring.

TYPE LOCALITY: Base of trees, Santee Canal (*Ravenell*).
DISTRIBUTION: Very rare; Norfolk, Virginia; Georgia.
ILLUSTRATION: Sull. Ic. Musc. *pl. 35*.

Section 2. Calyptoporus (Lindb.) Grout, comb. nov. [*Dorcadion* A.] *Calyptoporus* Lindb. Musci Scand. 28. 1879. Stomata immersed (cryptopore).

Subsection 1. Rivularia* Venturi in Husnot, Musc. Gall. 176. 1887. Plants aquatic; leaf-apex rounded-obtuse, the margins revolute; autoicous; capsules immersed; segments of the peristome well developed.

21. **Orthotrichum rivulare** Turner, Musc. Hib. 96. 1804.

Plants blackish-green, aquatic, in floating or submerged tufts; stems 2–4 cm. long, sparingly branched above; leaves loosely imbricate when dry, oblong-lingulate, obtuse, often irregularly toothed at the apex, ± 3 mm. long, the margins revolute to near the apex, decurrent; costa strong, ending shortly below the apex; leaf-cells except at the base papillose on both sides with low, simple papillae, the upper rounded, rather irregular, nearly isodiametric, 10–12 μ in diameter, the basal rectangular; autoicous; seta short; capsules immersed to emergent, the short neck sometimes abruptly contracted to the seta, 8-ribbed, oblong-ovoid to ovoid, strongly contracted below the mouth when dry and empty, the urn about 2 mm. long, dark red at the mouth; calyptra naked, deeply plicate; exothecial cells of the ribs well differentiated; stomata immersed, near the base of the capsule; operculum conic-apiculate; peristome double, the 16 teeth in pairs, recurved when dry, papillose, the papillae tending to fuse into irregular groups, the 16 segments slender, 8 about the length of the teeth, the alternating shorter, smooth, more or less appendiculate; spores 15–18 μ in diameter, maturing in spring.

TYPE LOCALITY: Europe.
DISTRIBUTION: On rocks, or occasionally on wet wood or the bases of trees; apparently common in parts of California; Oregon; Washington; Idaho.
ILLUSTRATIONS: Turner, Musc. Hib. *pl. 8;* B.S.G. Bryol. Eur. *pl. 219;* Braithw. Brit. Moss-Fl. 2: *pl. 57B;* Husnot, Musc. Gall. *pl. 48*.

22. **Orthotrichum Sprucei**† Mont.; Spruce, Lond. Jour. Bot. 4: 186. 1845.

Loosely cespitose, 2–3 cm. high, dark green; stems erect, branching; upper leaves lingulate, 3.5–4 mm. long, 1–1.5 mm. broad, the lower smaller, lanceolate from a broadly ovate base, the apex roundish, entire, or obtuse and slightly toothed or apiculate, the margins revolute at the

* As "Orthotricha rivularia."
† As "Sprucii," here treated as an orthographic error.

base, sometimes recurved above; costa ending far below the apex; upper leaf-cells rounded-hexagonal, 12–16 μ in diameter, the walls scarcely thickened, reddish, the papillae single, minute, or wanting, the basal cells short-rectangular to quadrate; perichaetial leaves subacute, costate nearly to the apex, their margins much less revolute; autoicous; capsules immersed, thick, obovoid, when dry constricted under the mouth, deeply ribbed to the middle, the striae 8, broad, of 4–6 rows of cells, the neck short, abruptly narrowed into the seta; calyptra naked; stomata immersed, mostly in the neck of the capsule; annulus double or triple; operculum conic-rostellate, red-margined; peristome double, the teeth 16, colored, sometimes approximate in pairs, when dry radially spreading, each interruptedly cleft almost to the base in the middle line, the papillae minute and arranged more or less in lines, 8 of the 16 cilia robust, equaling the teeth in length, papillose below, the intermediate 8 rudimentary or abortive.

TYPE LOCALITY: England.
DISTRIBUTION: On rocks in a brook; near Lyle, Washington, alt. 1000 feet (*Bailey*); Europe.
ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 214;* Braithw. Brit. Moss-Fl. 2: *pl. 57C;* Husnot, Musc. Gall. *pl. 48.*
EXSICCATI: Holz. Musci Acroc. Bor. Am. *571.*
NOTE: Bailey's is the only American specimen seen that could be referred to this species. It was issued as *O. euryphyllum*, but is intermediate between the two species. The peristome-teeth are much shorter than in *O. euryphyllum* and lack the outer plates. The English type has the leaf-margins less recurved above. Dr. Venturi identified as this species a plant collected by Leiberg "on willows overhanging the old channel of Clark's Fork of the Columbia River—Sept. 14, 1889."

23. **Orthotrichum euryphyllum** Venturi: Röll, Bot. Centr. 44: 417. 1890.

Loosely cespitose, 2–3 cm. high, dark green; stems erect, branching; leaves lanceolate from a broadly ovate base, the apex roundish, entire, or obtuse and slightly toothed, the upper 3.5 mm. long, 1–1.5 mm. broad, the lower smaller, the margins revolute nearly to the apex so that this is sometimes inversely cucullate; costa ending far below the apex; leaf-cells hexagonal, 12–16 μ in diameter, their walls not thickened, reddish, the papillae single, minute, or wanting, the basal cells turgid, almost inflated, parenchymatous; autoicous; seta short; capsules immersed, thick, broadly ovate, when dry constricted under the mouth, abruptly narrowed to the seta, with 8 broad striae of 4-6 rows of cells; calyptra naked, plicate; stomata immersed in the neck of the capsule, almost covered by the bordering cells; annulus double or triple; operculum conic-apiculate, red at the margin; peristome double, the teeth 16, reddish, up to 0.5 mm. long, slender, with interrupted additional plates at the back, approximate in pairs, when dry radially spreading, each interruptedly cleft almost to the base in the middle line, papillose, the papillae minute and arranged in more or less regular lines, the segments 8, robust, as long as the teeth, papillose below, with occasionally 8 abortive intermediate segments; spores 16–19 μ in diameter.

TYPE LOCALITY: On stones, Ellensburgh, Washington (type material seen).
DISTRIBUTION: Washington.
ILLUSTRATION: Grout, Moss Fl. N. Am. 2: *pl. 50A.*

Subsection 2. Cupulata (Venturi) Grout, stat. nov. Sect. *Orthotricha cupulata* Venturi in Husnot, Musc. Gall. 158. 1887.

24. **Orthotrichum anomalum** Hedw. Sp. Musc. 162. 1801.

Orthotrichum canadense Bruch & Schimp. Lond. Jour. Bot. 2: 667. 1843.

In rather dense mats or tufts, dark green to almost black, rather rigid, 1–2 cm. high, sparingly branched; leaves closely imbricate when dry, ovate-lanceolate to oblong-lanceolate, rather abruptly acute to narrowly obtuse at the apex, 1.7–2.5 mm. long, the margins entire, strongly revolute; costa strong, reaching nearly to the apex; basal leaf-cells rectangular, usually hyaline, often thin-walled, smooth, the upper rounded-hexagonal, incrassate, papillose, about 10–15 μ in diameter, in a single layer; autoicous; capsules faintly ribbed just after the operculum falls, when moist ovoid to ovoid-cylindric, when very old somewhat narrowed below the mouth, when thoroughly dry and empty cylindric, tapering rather sharply at the base, usually quite exserted (the perichaetial leaves sometimes reaching the base of the capsule when moist), with 8 plain ribs and often with 8 less distinct ribs between, the urn 1.5–2 mm. long; calyptra moderately hairy; exothecial cells very distinctly differentiated along the principal ribs; stomata

immersed; annulus present; operculum conic-rostrate; peristome-teeth 16, more or less paired, marked with faint sinuous lines, irregular in length and direction, typically with a short preperistome which is lacking or difficult to see in American plants, the segments rudimentary or absent, occasionally as long as the teeth but very slender and fragile; spores maturing in early spring.

TYPE LOCALITY: Europe.

DISTRIBUTION: On stones, chiefly calcareous; Canada, north to the Yukon Territory; common in limestone regions in the northeastern United States, west to the Rocky Mountains, south to New Mexico; Europe; Asia; Africa.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 210;* Braithw. Brit. Moss-Fl. **2**: *pl. 57A;* Rab. Krypt.-Fl. **4**: *f. 216;* Husnot, Musc. Gall. *pl. 44.*

EXSICCATI: Sull. & Lesq. Musci Bor. Am. *119;* Aust. Musci App. *160;* Holz. Musci Acroc. Bor. Am. *64, 64a;* Grout, N. Am. Musci Perf. *175.*

NOTE: In the herbarium of the New York Botanical Garden Drummond's Musci Am. *151,* the type of *Orthotrichum canadense,* is certainly a form of *O. anomalum.* See notes on this species in Grout, Moss Fl. N. Am. **2**: 122.

Orthotrichum anomalum var. **saxatile** (Brid.) Milde, Bryol. Siles. 171. 1869. *Orthotrichum saxatile* Brid. Musc. Recent. **2**[3]: 27. 1801. Seta usually longer; capsules narrowly cylindric when dry, 8-striate; peristome-teeth more united in pairs, the segments fairly well developed, linear. TYPE LOCALITY: Europe. DISTRIBUTION: Niagara Falls; Washington; Yukon Territory; New Mexico (*Wooton 3762,* in part). ILLUSTRATION: Schimp. Musci Eur. Novi (**1–2**:): *pl. 10.* EXSICCATI: Sull. & Lesq. Musci Bor. Am. *119;* ed. *2, 177.* NOTE: R. S. Williams' specimen from Dawson, Yukon Territory, has capsules of this variety, but some very broad leaves, ovate at the base.

25. **Orthotrichum cupulatum** Brid. Musc. Recent. **2**[2]: 25. 1801.

Plants closely resembling *O. anomalum* in gametophytic characters; leaves often broadly ovate-lanceolate and obtuse, the margins somewhat revolute; leaf-papillae sometimes salient and forked; autoicous; seta less than 1 mm. long; capsules more or less emergent, rarely almost exserted, subglobose to obovoid, abruptly narrowed to the seta, when dry oblong-cylindric, becoming urceolate with age, 1.5 mm. long, with 8 strong ribs and 8 less prominent between; calyptra broadly campanulate, sparsely hairy, straw-yellow when dry; exothecial cells differentiated along the major ribs; stomata about the middle of the capsule, immersed; annulus present; operculum conic-rostellate; peristome single or with rudiments of segments, the teeth spreading when dry, often with a distinct preperistome, striate with fine sinuous lines; spores maturing in summer.

TYPE LOCALITY: Germany.

DISTRIBUTION: On stones and ledges, especially those containing lime; rare in most parts of North America; British Columbia; Oregon; frequent in Utah, Idaho; Asia; Africa.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 209;* Braithw. Brit. Moss-Fl. **2**: *pl. 56E;* Husnot, Musc. Gall, *pl. 44;* Grout, Moss Fl. N. Am. **2**: *pl. 53A.*

Orthotrichum cupulatum var. **nudum** (Dicks.) Braithw. Brit. Moss-Fl. **2**: 78. 1889. *Orthotrichum nudum* Dicks. Pl. Crypt. Brit. **4**: 6. 1801. *Orthotrichum Rudolphii* Lehm.; Hoppe, Flora **10**: 656. 1827 (nomen nudum). *Orthotrichum cupulatum* var. *Rudolphianum* Schimp. Syn. 261. 1860. *Orthotrichum nudum* var. *Rudolphianum* C. Müll. & Kindb. in Macoun, Cat. Can. Pl. 87. 1883. Tufts wider, looser, deep green; capsules almost exserted, with a longer tapering neck; calyptra nearly hairless; peristome-teeth more strongly striolate, with a much more fully developed preperistome. TYPE LOCALITY: England. DISTRIBUTION: Niagara Falls (*Drummond 152*); Great Falls, Montana (*Williams 59*); Lake Pend d'Oreille, Idaho (*Leiberg 185,* on granite); ? British Columbia (*Macoun*). ILLUSTRATION: Dicks. Pl. Crypt. Brit. *pl. 10, f. 13.* NOTE: The lines on the peristome-teeth of American *O. cupulatum* are rarely as distinct as in the European form, often tending to become rows of joined papillae as in *O. strangulatum.*

26. **Orthotrichum urnigerum** Myrin, Coroll. Fl. Ups. 71. 1834.

Differing from *O. cupulatum* in having leaves acute to slenderly acuminate, strongly papillose with large, salient papillae; peristome double with 8–16 well developed segments, the teeth having large, irregular papillae at the base, striate above.

TYPE LOCALITY: Europe.

DISTRIBUTION: Yellowstone National Park, Wyoming.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 222;* Husnot, Musc. Gall. *pl. 45.*

NOTE: This rare European species was identified by Venturi from Röll's collections. It is not reported elsewhere from North America, and its occurrence is considered doubtful.

27. **Orthotrichum strangulatum** Beauv. Prodr. Aeth. 81. 1805.

Orthotrichum parvulum Mitt. Jour. Linn. Soc. 8: 25. 1864.
Orthotrichum Porteri Sull. & Lesq.; Aust. Musci App. 28. 1870.
Orthotrichum Peckii Sull. & Lesq.; Aust. Musci App. 29. 1870.
Orthotrichum cupulatum var. *Peckii* Sull. Ic. Musc. Suppl. 61. 1874.
Orthotrichum cupulatum var. *Porteri* Sull. Ic. Musc. Suppl. 61. 1874.
Orthotrichum cupulatum var. *parvulum* Sull. Ic. Musc. Suppl. 61. 1874.

Plants in dense, thin mats, very dark, almost black except the young tips, 1 cm. or less in height; upper and perichaetial leaves often slenderly acute but otherwise hardly to be distinguished from those of *O. anomalum;* some lower leaves nearly plane-margined and obtuse, often bistratose on the margins above; costa occasionally percurrent; basal leaf-cells rather shorter than in *O. anomalum*, short-rectangular to quadrate, the upper papillose with low, simple papillae; autoicous; seta about 0.5 mm. long; capsules about 1.5 mm. long, tapering to the seta, typically subcylindric and about half-emergent when dry, oblong-cylindric and often nearly immersed when moist, 8-ribbed; calyptra hairy with papillose hairs; exothecial cells differentiated along the ribs; stomata immersed, about the middle of the capsule; annulus present; operculum conic-rostellate; peristome usually single, the teeth 16, more or less paired, erect to spreading, papillose, the papillae often joined in vague, irregular, branched ridges; spores maturing in spring.

TYPE LOCALITY: Pennsylvania (*Muhlenberg*).
DISTRIBUTION: On limestone; Vermont and Pennsylvania, west to Minnesota and Utah, south to Missouri, Tennessee, and Kentucky.
ILLUSTRATIONS: O. Jennings, Mosses W. Pa. *pl. 14;* Grout, Moss Fl. N. Am. *pl. 53B;* Schwaegr. Suppl. *pl. 54.*
EXSICCATI: Aust. Musci App. *161;* Holz. Musci Acroc. Bor. Am. *65;* Grout, N. Am. Musci Perf. *215;* Sull. & Lesq. Musci Bor. Am. *117* (as *O. Sturmii*).
NOTE: The forms from eastern United States have bistratose margins and frequent bistratose streaks, while those west of the Mississippi seem to be consistently unistratose throughout.

Orthotrichum strangulatum var. **missouricum** (Holz.) Grout, Moss Fl. N. Am. **2**: 123. 1935. *Orthotrichum missouricum* Holz.; Grout, Moss Fl. N. Am. **2**: 123, as syn. 1935. Leaf-margins thickened, of 5 or more layers of cells; sporophytes unknown. TYPE LOCALITY: Near Clayton, Missouri (*P. M. Lawrence*). DISTRIBUTION: Known only from the type locality.

28. **Orthotrichum Lescurii** Aust. Musci App. 29. 1870.

Orthotrichum cupulatum var. *minus* Sull. Ic. Suppl. 61. 1874.

Leaves more slenderly lanceolate than in the preceding species; capsules immersed, more abruptly contracted to the seta, globose-obovoid when moist, the urn usually less than 1.5 mm. long; stomata fewer; peristome-teeth 16, more or less grouped in pairs, slender, more finely and faintly papillose than in the preceding, more or less open along the divisural line.

TYPE LOCALITY: Northern New Jersey.
DISTRIBUTION: On limestone, sometimes on granite or traprock; "from New England to Ontario south to Arizona, Missouri, and Pennsylvania, and in the Rocky Mountains to British Columbia" (O. Jennings, Mosses W. Pa. 119).
ILLUSTRATIONS: Sull. Ic. Musc. Suppl. *pl. 44;* O. Jennings, Mosses W. Pa. *pl. 15;* Grout, Moss Fl. N. Am. **2**: *pl. 53C.*
EXSICCATI: Aust. Musci App. *163;* Grout, N. Am. Musci Perf. *439.*

29. **Orthotrichum Hallii** Sull. & Lesq. in Sull. Ic. Musc. Suppl. 63. 1874.

Orthotrichum leiodon Kindb. Hedwigia **42**: Beibl. 17. 1903.

Plants dark green, in rather dense, wide tufts; stems ± 1 cm. long, branching above; leaves loosely imbricate and somewhat contorted when dry, elongate-lanceolate, narrowly obtuse, keeled, costate to near the apex, bistratose above, papillose with stout simple papillae except at the base, the margins revolute about half-way to the apex, in some upper and perichaetial leaves nearly to the apex; basal leaf-cells rectangular, about 12 μ wide, 2–3 times as long as broad, thin-walled and pellucid, the upper dense, rounded-hexagonal, 10–12 μ in diameter; monoicous; seta 1 mm. long or less; capsules immersed when moist, obovoid, about 1.5 mm. long, 8-ribbed when dry and empty; calyptra hairy; exothecial cells rather thin-walled and

soft, differentiated along the ribs, at the mouth of the capsule 6–12 rows of incrassate, round or transversely elongate cells; stomata immersed; annulus present; operculum mammillate-rostrate; peristome double, the teeth 16, paired, erect until very old, vermicular-striate throughout, the segments linear, fugacious; spores maturing in summer.

TYPE LOCALITY: "On trees," Rocky Mts. in Colorado (*Elihu Hall*); all subsequent collections have been from rocks.

DISTRIBUTION: Apparently not rare in the Rocky Mountains; New Mexico, Colorado, and Wyoming, alt. 6000–10,000 ft.

ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 45.*

EXSICCATI: Holz. Musci Acroc. Bor. Am. *90, 90a.*

NOTE: Nearer to *O. cupulatum* than has been realized; distinguished by the more elongate capsule, the presence of segments, the more finely striate teeth, and the leaves which are bistratose above. The teeth as a rule are broader and more closely paired. A specimen of *O. cupulatum* from Wales, from herb. Wilson, has the teeth almost as striate as in *O. Hallii.* Forms referable to *O. cupulatum* or *O. Hallii* in other respects are occasionally found with papillose peristome-teeth. American *O. cupulatum* frequently has bistratose streaks above.

30. **Orthotrichum alpestre** Hornsch.; B.S.G. Bryol. Eur. (42:) Orthotr. Suppl. 1, 1. 1849.

Orthotrichum stramineum sensu Bruch & Schimp. in B.S.G. Bryol. Eur. (2–3:) Orthotr. 23, in part, 1837. Doubtfully *O. stramineum* Hornsch. 1827.

Plants in rather dense tufts or mats, 1–2 cm. high, bright to dark green; leaves loosely imbricate, more or less contorted when dry, lanceolate to ovate-lanceolate, keeled, acute or sometimes apiculate at the apex, about 3 mm. long, the margins strongly revolute except at the base; costa disappearing in the apex; basal leaf-cells smooth, rectangular, rather thin-walled and clear or brownish, the upper rounded-hexagonal, 10–12 μ in diameter, bearing large, simple, forked papillae; monoicous; seta about 0.5 mm. long; capsules more or less emergent, obovoid to pyriform, the neck distinct, 1.2–2 mm. long, 8-ribbed, subcylindric and strangulate when dry; calyptra with a few hairs; exothecial cells differentiated along the ribs, thinner-walled and more transparent than in most species; stomata immersed; operculum conic-apiculate; peristome double, the teeth 16, at first united in pairs, sometimes more or less perforate above, finely papillose, the papillae on the lower part of the teeth separate or in faint irregular designs, in the upper part in faint vertical lines and lighter-colored than below, the segments linear, 8, nearly as long as the teeth, of 2 rows of cells below, smooth; spores maturing in summer.

TYPE LOCALITY: Near Heiligenblut, Austria.

DISTRIBUTION: On rocks, preferring dolomite and limestone, occasionally on trees; the Rocky Mountains to the Yukon Territory; more common in Colorado and Utah; Mt. Whitney; usually at relatively high altitudes; Europe; Asia.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 213;* Husnot, Musc. Gall. *pl. 50;* Rab. Krypt.-Fl. 4: *f. 230.*

EXSICCATI: Drummond, Musci. Am. *149.*

NOTE: The pattern made by the papillae on the upper portion of the peristome-teeth of *O. alpestre* is not so fixed in North America as in Europe.

Orthotrichum alpestre var. **occidentale** (T. P. James) Grout, Moss Fl. N. Am. 2: 124. 1935. *Orthotrichum occidentale* T. P. James; S. Wats. Bot. King's Expl. 402. 1871. *Orthotrichum alpestre* "var." Sull. Ic. Musc. Suppl. 69. 1874. *Orthotrichum alpestre* var. *majus* Lesq. & James, Man. 169. 1884. Often more robust than the species, glaucous-green; leaf-cells with longer papillae, simple or double; peristome-teeth longer, finely papillose above but the papillae not in lines. TYPE LOCALITY: Uinta Mountains, Provo Cañon, Utah, alt. 8000 ft. DISTRIBUTION: The Rocky Mountain region. ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 51.*

Orthotrichum alpestre var. **Watsoni** (T. P. James) Grout, Moss Fl. N. Am. 2: 125. 1935. *Orthotrichum Watsoni* T. P. James; S. Wats. Bot. King's Expl. 401. 1871. Very robust, light green; leaves reaching 4 mm. in length; perichaetial leaves longer than the seta and the long-necked capsule together; peristome-teeth nearly smooth above. TYPE LOCALITY: Nevada (*Watson*). DISTRIBUTION: The Rocky Mountain region. ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 54.* NOTE: See Grout, Moss Fl. N. Am. 2: 125.

31. **Orthotrichum Jamesianum** Sull.; S. Wats. Bot. King's Expl. 401. 1871.

Plants in dense, thin tufts or cushions, pale green above; stems reaching 1 cm. in height, little branched; leaves oblong to oblong-lanceolate, broadly or narrowly obtuse, reaching 2 mm. or more in length, the margins revolute, densely papillose except at the base, the narrow, salient papillae simple or furcate, nearly opaque above; costa stout, ending just below the apex, scarcely

attenuate; upper leaf-cells rounded-hexagonal, indistinct, about 12 μ in diameter, the median basal cells oblong-rectangular, 2–3 times as long as broad, the marginal smaller; monoicous; capsules immersed to slightly emergent, pyriform with a short neck, the urn about 1 mm. long, when dry 8-ribbed and constricted below the mouth; calyptra with a few papillose hairs; exothecial cells differentiated along the ribs; stomata immersed, nearly hidden; annulus present, below it 6–8 rows of small incrassate cells; operculum strongly apiculate; peristome single, the 16 teeth reflexed, striate; spores papillose.

TYPE LOCALITY: On limestone rocks, East Humboldt Mts., Nevada, alt. 7500 ft. (*Watson;* cotype in the U. S. National Museum).
DISTRIBUTION: Nevada, British Columbia, and Alberta.
ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 53.*
EXSICCATI: Macoun, Canad. Musci *107a, 129* (as *O. consimile*).

Subsection 3. Straminea* Venturi in Husnot, Musc. Gall. 177; emend Grout. Corticolous; capsules 8-ribbed (except in *O. pusillum*); operculum conic-apiculate; peristome-teeth mostly united in pairs (except in *O. pusillum*), usually reflexed when dry.

32. **Orthotrichum tenellum** Bruch; Brid. Bryol. Univ. 1: 786. 1827.

Plants in small, short, deep green cushions ± 1 cm. high; leaves rather loosely imbricate when dry, multiform on one plant, lingulate-lanceolate to oblong-lanceolate, concave, rounded and obtuse at the apex (infrequently acute), 2 mm. or more long, the margins recurved to the apex; costa ending below the apex, which is rarely slightly serrulate; upper leaf-cells irregular, rounded-hexagonal, incrassate, nearly isodiametric, 10–12 μ in diameter, more or less papillose, the basal rectangular to quadrate on the margins, more elongate near the costa, smooth, mostly hyaline; autoicous; seta less than 1 mm. long; capsules more or less emergent, oblong-cylindric to shortly cylindric when moist, the neck about as long as the seta, when dry narrowly cylindric, deeply 8-ribbed the whole length, little or not at all contracted under the mouth, about 1.5–2 mm. long; calyptra long-conic, covering the spore-sac, sparsely hairy; exothecial cells strongly differentiated; stomata on the neck near the base of the spore-sac, immersed, nearly covered by the overlapping cells; annulus present; peristome double, the 16 teeth united in pairs, papillose, reflexed when dry, the segments linear, shorter than the teeth; vaginula glabrous; spores maturing in spring.

TYPE LOCALITY: Germany.
DISTRIBUTION: On the bark of trees; California and the Rocky Mountain region from New Mexico to Alberta; Europe; Africa.
ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 212;* Husnot, Musc. Gall. *pl. 50;* Braithw. Brit. Moss-Fl. **2**: *pl. 58B.*
EXSICCATI: Holz. Musci Acroc. Bor. Am. *593* (as *O. consimile*).
NOTE: The description in Lesquereux & James' *Manual* is misleading in many particulars, and European authors do not agree. The leaves are very concave at the blunt apices. Flowers' plants from Utah have slightly serrulate leaves, spreading peristome-teeth, and naked calyptra.

Orthotrichum tenellum var. **Coulteri** (Mitt.) Grout, comb. nov. *Orthotrichum Coulteri* Mitt. Jour. Linn. Soc. **8**: 25. 1864. *Orthotrichum cylindrocarpum* Lesq. Trans. Am. Phil. Soc. **13**: 6. 1869. Leaves a little less concave at the apex, which is rather narrower also; capsules almost entirely above the perichaetial leaves even when moist. TYPE LOCALITY: Oakland, California. DISTRIBUTION: Known only from the type locality. ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 52.* EXSICCATI: Sull. & Lesq. Musci Bor. Am. ed. 2, *178* (cotypes); Ren. & Card. Musci Am. Sept. Exs. *219;* Baker, Pacif. Slope Bryoph. *340.*

33. **Orthotrichum malacophyllum** Card. Rev. Bryol. **38**: 2. 1911.

Plants small, the stems without leaves 2–4 mm. long, rather scattered; leaves loosely appressed and somewhat undulate when dry, erect-open when moist, soft, lingulate-lanceolate, broadly acute, large, 2–3 × 0.5–0.6 mm., carinate, a little narrowed to the insertion, broadly long-decurrent, the margins entire, recurved below, plane above; costa ending below the apex; upper leaf-cells rounded-hexagonal, ± 12 μ in diameter, smaller at the margins, minutely papillose, collenchymatous, not obscure, the basal and decurrent cells lax, pellucid, much larger, rectangular to rhomboidal, their walls strongly nodose and collenchymatous; perichaetial

* As "Orthotricha straminea."

leaves similar but broader; antheridial buds near the base of the stem; seta very short, less than half the length of the immersed capsule; capsule oblong in outline, truncate at the base with no neck, the urn about 2 mm. long, 8-ribbed when ripe and dry; calyptra sparingly hairy; operculum conic-rostrate; peristome double, the teeth united in pairs, minutely granulose, the segments of the inner peristome 8.

TYPE LOCALITY: La Cima near the boundary between Morelos and Mexico, on trees (*Barnes & Land 418*).

DISTRIBUTION: Known only from the type locality.

NOTE: A striking and distinct species. The large leaves, strongly decurrent, all their cells collenchymatous, and the basal nodules are distinctive and will enable sterile plants to be recognized.

34. **Orthotrichum Bartrami** R. S. Williams, Bryologist **28**: 76. 1925.

Plants in low, rather compact cushions on bark; stems mostly reclining, radiculose at the base, about 1 cm. high, often sparingly branched; leaves when dry erect and appressed, when moist widely spreading, the upper oblong-ovate, acutely or obtusely pointed, 2–2.5 mm. long, the margins slightly dentate and incurved at the apex, recurved below to near the base; costa not quite percurrent; leaf-cells distinct, round or oblong, incrassate, usually with 2 small papillae in the upper leaf, the median cells 8 × 8–12 μ, the basal pale, rectangular, smooth, up to 12 × 50–60 μ toward the costa; perichaetial leaves similar but the rectangular cells extending farther up; dioicous or autoicous; antheridial buds 2 or 3 together on separate plants or single on short branches a little below the perichaetium; seta about 1 mm. long; capsules emergent, about 1.5 mm. long, when moist slightly obovate, when dry more or less cylindric, 8-ribbed and contracted under the mouth; calyptra more or less hairy, 8-striate, nearly entire at the base; stomata immersed, scattered over the tapering neck; annulus present, persistent, of 2 or 3 rows of nearly square cells; operculum convex-apiculate; peristome papillose throughout, of 16 paired teeth and 8 slender segments; spores finely papillose, about 16 μ in diameter.

TYPE LOCALITY: On bark of oaks, Whitehouse Canyon, Santa Rita Mts., Arizona, alt. 6000 ft. (*E. B. Bartram 1465*).

DISTRIBUTION: Arizona.

EXSICCATI: Holz. Musci Acroc. Bor. Am. *570* (as *O. Douglasii*); E. Bartr. Mosses S. Ariz. *145* (as *O. cylindrocarpum*), *153;* Grout, N. Am. Musci Perf. *172*.

35. **Orthotrichum pallens** Bruch var. **parvum** Venturi, Hedwigia **12**: 21. 1873.

Close to *O. tenellum;* upper leaves obtuse, crenulate with projecting cells at the apex, the others various; upper leaf-cells reaching about 12 μ; antheridia on a short special branch; seta about 0.5 mm. long; capsules short-obovoid, about 1.5 mm. long, striate when dry and empty; calyptra conic-campanulate, naked; stomata only slightly covered by the surrounding cells, often seemingly almost superficial, at or near the middle of the spore-sac; operculum strongly apiculate.

TYPE LOCALITY: Yellowstone National Park, Wyoming (*Röll*, as "var. *parvum* Hedw.").

DISTRIBUTION: Wyoming and Utah.

ILLUSTRATION: Grout, Moss Fl. N. Am. 2: *pl. 55A*.

NOTE: *O. pallens* is credited to North America from specimens collected by Lyall on the Pack River, British Columbia. These are probably merely a form of *O. tenellum*. See Grout, Moss Fl. N. Am. 2: 127.

36. **Orthotrichum stellatum** Brid. Bryol. Univ. 1: 274. 1826.

Orthotrichum Braunii Bruch & Schimp. in B.S.G. Bryol. Eur. (2–3:) Orthotr. 16. 1837.
Orthotrichum strangulatum sensu Sull. Musci U. S. 33. 1856. Not *O. strangulatum* Beauv. 1805, nor Schwaegr. 1816.

Plants in small, dense cushions reaching 1 cm. in height, branched above; leaves appressed-imbricate when dry, broadly lanceolate, subacute to obtuse, keeled, ± 2 mm. long, papillose except at the base, the margins revolute sometimes nearly to the base and the apex, sometimes only in the middle; costa ending just below the apex; upper leaf-cells irregular, rounded, incras-

sate, isodiametric to slightly elongate, 10–13 μ in diameter, the basal quadrate to short-rectangular, their corners more or less rounded; autoicous; capsules 1–1.5 mm. long, rather abruptly contracted to the very short seta, obovoid-pyriform, immersed to emergent, when dry and empty very strongly 8-ribbed, dark-colored and strongly contracted under the mouth; calyptra plicate, naked; exothecial cells differentiated along the ribs; stomata immersed; annulus present, several rows of small incrassate cells below it; operculum conic-apiculate; peristome-teeth 16, united in pairs, reflexed when dry, pale yellow, finely papillose, not perforate at the apex, the segments narrowly linear, of 1 or 2 rows of cells, shorter than the teeth; spores 10–13 μ in diameter, maturing in late spring.

TYPE LOCALITY: South Deerfield, Mass.

DISTRIBUTION: On trees in the open, especially butternut and apple; common in eastern Canada and the northeastern United States, south to Georgia, west to Iowa.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 215;* Sull. Ic. Musc. *pl. 36;* Sull. Ic. Musc. Suppl. *pl. 47* (both as *O. strangulatum*); Husnot, Musc. Gall. *pl. 49;* Rab. Krypt.-Fl. 4: *f. 232.*

EXSICCATI: Drummond, Musci Am. *150,* in part (as *O. affine* var. *pumilum*); Aust. Musci App. *150;* Sull. & Lesq. Musci Bor. Am. *120;* ed. 2, *179;* Sull. Musci Allegh. *128;* Holz. Musci Acroc. Bor. Am. *469;* Grout, N. Am. Musci Perf. *407.*

37. **Orthotrichum ohioense** Sull. & Lesq.; Aust. Musci App. 30. 1870.

Orthotrichum canadense sensu Sull. & Lesq. Musci Bor. Am. *121.* 1856. Not *O. canadense* Bruch & Schimp. 1843.
Orthotrichum citrinum Sull. & Lesq.; Aust. Musci App. 31. 1870.

Plants in rather small, dense cushions, light green above, brownish below; stems 5–10 mm. long, branching above; leaves appressed-imbricate when dry, oblong-lanceolate, narrowly obtuse to obtusely acute, 1.7–3 mm. long, the margins entire, revolute; costa strong, ending a little below the apex; upper leaf-cells irregularly rounded, incrassate, nearly isodiametric, 10–12 μ in diameter, papillose, becoming elongate toward the base, smooth at the base, rectangular near the costa, quadrate at the margins; autoicous; capsules reaching about to the tips of the perichaetial leaves when moist, 1–1.3 mm. long, longer than the seta, oblong-ovoid, when dry and empty straw-colored, somewhat 8-ribbed, and slightly or not at all contracted under the mouth, the neck short or almost lacking; calyptra somewhat hairy, campanulate; 3–5 rows of upper exothecial cells incrassate-rounded, only the upper transversely elongate, those below differentiated along the ribs; stomata immersed, a little below the middle of the capsule; annulus narrow; operculum convex-apiculate; peristome-teeth 16, more or less united in pairs, densely and finely papillose, occasionally perforate at the tips, reflexed when dry, the segments linear, of 2 rows of cells, shorter than the teeth; spores 18–21 μ in diameter, papillose, maturing in early spring.

TYPE LOCALITY: Ohio.

DISTRIBUTION: On the bark of trees in rather open places; southeastern Canada and the eastern United States, south to Florida, west to Ohio and Ontario; Montana (according to O. Jennings, Mosses W. Pa. 120).

ILLUSTRATIONS: Sull. Ic. Musc. Suppl. *pl. 48;* O. Jennings, Mosses W. Pa. *pl. 15.*

EXSICCATI: Sull. & Lesq. Musci Bor. Am. *121;* ed. 2, *181;* Aust. Musci App. *169, 170.*

38. **Orthotrichum pumilum** Dicks. Pl. Crypt. Brit. 4: 5. 1801.

Orthotrichum affine β pumilum Hook. & Tayl. Musc. Brit. 74. 1818.
Orthotrichum inflexum C. Müll. Syn. 1: 690. 1849.
Orthotrichum Schimperi Hammar, Monogr. Orthotr. Ulot. Suec. 9. 1852.
Orthotrichum fallax Schimp. Syn. 264. 1860.
Orthotrichum brachytrichum Schimp.; Lesq. & James, Proc. Am. Acad. 14: 140. 1879.
Orthotrichum fallax var. *truncatulum* Aust. Bull. Torrey Club 6: 344. 1879.

Plants in short, close, dark green tufts, 1 cm. or less high; leaves imbricate when dry, not contorted, broadly to narrowly oblong-lanceolate, acute to narrowly obtuse, often apiculate with usually a single subhyaline cell at the apex, ± 2 mm. long, the margins revolute nearly to the apex; costa ending below the apex; upper leaf-cells larger and less dense than in most species, the walls thinner, slightly collenchymatous, 12–16 μ in diameter, irregularly rounded-hexagonal, papillose with low papillae, the basal cells smooth, oblong-rectangular near the

costa to quadrate on the margins; autoicous; seta about 0.5 mm. long, together with the broad neck of the capsule sheathed in the ochrea; capsules usually light-colored, immersed or slightly emergent, 1.5 mm. or less long, oblong to oblong-ovoid, abruptly narrowed to the seta, when dry 8-ribbed and contracted below the mouth; calyptra strongly plicate, naked or usually with a few very short hairs near the apex; exothecial cells differentiated; stomata immersed, the guard cells sometimes nearly covered by the surrounding cells, sometimes nearly all visible, both forms on one capsule; annulus present; peristome double, the 16 teeth usually united in pairs, finely papillose, reflexed when dry, rarely perforate above, the segments 8, linear, shorter than the teeth of 2 rows of cells at the base, easily broken; spores maturing in spring.

TYPE LOCALITY: Europe.
DISTRIBUTION: On the bark of trees; southeastern Canada and the eastern United States, south to Tennessee, west to Idaho and Utah; Europe; Canary Islands; Asia.
ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 211;* Husnot, Musc. Gall. *pl. 48;* Braithw. Brit. Moss-Fl. **2**: *pl. 57E* (the last two as *O. Schimperi*).
EXSICCATI: Aust. Musci App. *165;* Holz. Musci Acroc. Bor. Am. *89, 381.*
NOTE: The calyptra in American plants seems to be more frequently furnished with short hairs than it is in European plants.

Orthotrichum pumilum var. **fallax** (Bruch) Grout, Moss Fl. N. Am. **2**: 128. 1935. *Orthotrichum pumilum* Sw. Disp. Musc. Suec. 42. 1799; not *O. pumilum* Dicks. 1801. *Orthotrichum fallax* Bruch; Brid. Bryol. Univ. 1: 787. 1827. Capsules emergent half-way or more, light yellow, blackish when old, longer, oblong-cylindric, the neck tapering, narrowly cylindric and the mouth flaring when old. TYPE LOCALITY: Sweden. DISTRIBUTION: Montana (*Williams,* det. Venturi); Idaho (*Sandberg & al. 1142*); Utah (*Flowers 926, 1864,* etc.). ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 211;* Sw. Disp. Musc. Suec. *pl. 4, f. 9.* NOTE: These American plants seem to agree with the European *O. pumilum.* They are distinctly western and are recognizable when young by the light-colored capsules, which seem almost exserted when dry.

39. **Orthotrichum Garretti** Grout & Flowers; Grout, Moss Fl. N. Am. **2**: 128. 1935.

Plants in thin, dark green cushions, 1 cm. high or less; leaves loosely imbricate and somewhat contorted when dry, broadly lanceolate, broadest a little above the base, concave, often bearing numerous septate brood-bodies, the apices slenderly acute to acuminate, often serrulate and tipped with one or more hyaline elongate cells, very brittle and often broken off, the upper leaves reaching 2.7 mm. in length, the margins revolute nearly to the apex; costa strong, ending below the apex; upper leaf-cells strongly papillose, the papillae rather broad and low, or sharp and salient near the apex, rounded and nearly isodiametric, 10–20 μ in diameter, the walls thin for the genus, densely chlorophyllose, the basal cells short-oblong-rectangular, quadrate on the margins; antheridia not seen; seta 0.5 mm. long; capsules emergent, short-oblong, including the conic-apiculate operculum about 2 mm. long, 8-ribbed, the neck about the length of the seta; calyptra campanulate, bearing a few short hairs near the apex; stomata immersed; peristome-teeth 16, short, about 0.18 mm. long, finely papillose, more or less united in pairs at first, often narrowly perforate above, the segments of 2 rows of cells, nearly or quite as long as the teeth, rather sparingly papillose, appendiculate with several very long processes reaching half-way or more to the next segment; spores maturing in spring.

TYPE LOCALITY: On sandstone, Emma Park, Carbon County, Utah (*Flowers 834*).
DISTRIBUTION: Utah; near Columbus, Ohio; Lake Rupert, Canada (*Lepage*).
ILLUSTRATION: Grout, Moss Fl. N. Am. **2**: *pl. 55B.*
NOTE: The large leaf-cells and apiculate apices remind one of *O. pumilum,* but the apices are much longer and often hyaline, while the peculiar long, appendiculate segments separate it from any allied forms.

40. **Orthotrichum pusillum** Mitt. Jour. Linn. Soc. **8**: 25. 1864.

Orthotrichum psilocarpum T. P. James, Trans. Am. Phil. Soc. **13**: 110. 1869.

Plants small, blackish-green, 5 mm. high or less, in loose patches; upper leaves larger than the lower, broadly oblong-lanceolate to oblong-lingulate, narrowly to broadly obtuse, keeled, some or all denticulate at the apex, 1.5–2.5 mm. long, the margins strongly revolute; upper leaf-cells irregularly rounded, incrassate, about 15 μ in diameter, papillose, the basal shortly rectangular, 2–4 times as long as broad, shorter on the margins; monoicous; capsules almost

sessile, nearly or quite immersed, subglobose to ovoid, short-oblong when dry, smooth except occasionally when very old and dry, never ribbed, whitish, the urn about 1.6 mm. long; calyptra plicate, naked; exothecial cells thin-walled except a few rows around the mouth of the capsule, not otherwise noticeably differentiated; stomata immersed, about the middle of the capsule; annulus present; operculum convex-umbonate; peristome-teeth 16, densely and coarsely papillose, reflexed when dry, the segments slender, short, easily broken; spores about 15 μ in diameter, maturing in early spring.

TYPE LOCALITY: Pennsylvania.
DISTRIBUTION: On the bark of trees; New England to Florida, west to Illinois and Missouri.
ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 50* (as *O. psilocarpum*).
EXSICCATI: Drummond, So. Mosses *82* (in part, as *O. affine* var. *pumilum*); Sull. & Lesq. Musci Bor. Am. ed. 2, *180;* Aust. Musci App. *171.*
NOTE: *O. pumilum* and *O. pusillum* are both minute, dark-colored plants with nearly or quite naked calyptra, strongly papillose peristome-teeth, and large leaf-cells, and the leaves of both are occasionally somewhat denticulate at the apex, rarely so in the former and frequently in the latter. *O. pumilum* has the capsules oblong, plainly ribbed and contracted below the mouth when dry, the exothecial cells plainly differentiated, and the peristome-teeth closely united in pairs; while *O. pusillum* has the capsules smooth or very slightly wrinkled when dry, shorter, subglobose, the exothecial cells scarcely differentiated, and the teeth soon separated; but these intergrade in various ways so that some specimens may be referred equally well to either. In general, *O. pumilum* has the more northern range.

Subsection 4. Pulchella* Venturi in Husnot, Musc. Gall. 191. 1887; emend Grout. Leaves crispate when dry, linear-lanceolate; segments of the inner peristome linear, as long as the teeth.

41. **Orthotrichum pulchellum** Brunton; Winch, Bot. Guide **2**: 23. 1807.

Plants yellowish-green to olive-green, in loose, soft tufts, 1 cm. or less in height; leaves when dry flexuous to crispate, linear-lanceolate, slenderly acute at the apex, occasionally having an apiculus of 1 or 2 cells, 2.5–3 mm. long, the margins revolute except near the apex; costa ending below the apex; upper leaf-cells incrassate, irregularly rounded, nearly isodiametric, faintly papillose, ± 10 μ in diameter, the basal smooth, quadrate on the margins, elongate near the costa, more incrassate than in most species; autoicous; seta about 1.5 mm. long; capsules almost exserted, oblong-ovoid, contracted into a short neck, 8-ribbed when dry, little or not at all contracted under the mouth; calyptra naked; exothecial cells strongly differentiated along the ribs; stomata in one or more rows in the middle and upper parts of the spore-sac, immersed; annulus present, 3–5 rows of small, round, incrassate cells below it; operculum short-rostrate; peristome-teeth 16, dark orange-red, more or less united in pairs, erect or spreading, later separated and reflexed, papillose, the papillae often arranged in indefinite lines, striate and often split at the apex, the segments 8–16, filiform; spores maturing in spring.

TYPE LOCALITY: Durham, England.
DISTRIBUTION: On trees; the west coast of the United States; British Columbia; Alaska.
ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 223;* Smith, Eng. Bot. *pl. 1787;* Husnot, Musc. Gall. *pl. 52;* Braithw. Brit. Moss-Fl. **2**: *pl. 58C.*

Orthotrichum pulchellum var. **columbicum** (Mitt.) Grout, Moss Fl. N. Am. **2**: 130. 1935. *Orthotrichum columbicum* Mitt. Jour. Linn. Soc. **8**: 24. 1864. Differing in the shorter seta, the smaller immersed capsules, and the narrower leaves; in the specimens examined only 1 or 2 rows of small rounded cells below the mouth of the capsule. TYPE LOCALITY: On trees, Vancouver Island (*Lyall;* type seen). DISTRIBUTION: Known only from the type locality. EXSICCATI: Holz. Musci Acroc. Bor. Am. *514.*

42. **Orthotrichum consimile** Mitt. Jour. Linn. Soc. **8**: 24. 1864.

? *Orthotrichum Winteri* Schimp. Musci Eur. Novi (**3–4**:) Orthotr. 1. 1866.
Orthotrichum pulchellum sensu Lesq. & James, Man. 175. 1884. Not *O. pulchellum* Brunton, 1807.
Orthotrichum pulchellum var. *longipes* Sull.; Lesq. & James, Man. 175. 1884.
Orthotrichum pulchellum var. *leucodon* Venturi: Röll, Bot. Centr. **44**: 419. 1890.
Orthotrichum ulotaeforme Ren. & Card. Bot. Gaz. **15**: 42. 1890.
Orthotrichum Hendersoni Ren. & Card. Bot. Gaz. **15**: 42. 1890.
Orthotrichum pulchellum var. *productipes* Ren. & Card. Bot. Gaz. **15**: 43. 1890.
Orthotrichum glabrum Venturi: Röll, Hedwigia **32**: 285. 1893. (Nomen nudum.)

* As "Orthotricha pulchella."

Plants typically characterized by the light yellow-green color and the *Ulota*-like appearance due to the long, linear-lanceolate, crispate leaves; occasionally these characteristics not very apparent; leaves slenderly acuminate to subobtuse, reaching 3 mm. in length; upper leaf-cells incrassate, rounded, nearly isodiametric, strongly papillose, the basal smooth and rectangular; autoicous; seta up to 4 mm. long; capsules usually well exserted, short-oblong, when old much shrunken and 8-ribbed to the base, rather abruptly narrowed to the seta by a short neck, the urn 1.5–2 mm. long; calyptra naked or with a few hairs; exothecial cells strongly differentiated along the ribs; stomata very numerous around the base of the spore-sac, occasionally occurring near its middle part; annulus present; operculum conic-rostellate; peristome-teeth 16, pale, faintly papillose often in faint patterns, at first united in pairs and erect, later separating and reflexed, the segments well developed, narrowly linear, nearly or quite as long as the teeth, 8 or 16 in vigorous plants, slightly swollen at the joints; spores maturing in spring.

TYPE LOCALITY: On trees, Vancouver Island (*Lyall*).

DISTRIBUTION: On trees; California to Alaska; common on the west coast of the United States, rare east of the Coast Ranges.

ILLUSTRATIONS: Sull. Ic. Musc. Suppl. *pl. 43;* Bot. Gaz. **15**: *pl. 7A* (as *O. Hendersoni*), *7B* (as *O. ulotaeforme*).

EXSICCATI: Holz. Musci Acroc. Bor. Am. *109* (as *O. pulchellum*), *110, 515* (as *O. pulchellum leucodon*); Howe, Musci Calif. *74, 81* (as *O. pulchellum*); Macoun, Can. Musci *125;* Allen, Mosses Cascade Mts. *42* (as *O. ulotaeforme*).

NOTE: Mitten's type at the New York Botanical Garden has slightly contorted leaves, the capsule scarcely exserted, and the calyptra bearing numerous hairs. *O. Hendersoni* is a form with short seta and slender crispate leaves (type seen). The type of *O. ulotaeforme* has crispate leaves and an unusually long seta. *Leiberg 233* from Idaho, referred by Cardot to *O. Rogeri,* is this species; this is the only report of *O. Rogeri* from North America. *O. Winteri* Schimp. is reported from Vancouver Island, but all Macoun's *O. Winteri* that I have seen, including that at Ottawa, is *O. consimile.* The characters that separate *O. Winteri* from *O. pulchellum* are precisely those that distinguish *O. consimile.*

Subsection 5. Diaphana (Venturi) Grout, stat. nov. Sect. *Orthotricha diaphana* Venturi in Husnot, Musc. Gall. 193. 1887. Corticolous; leaves with a slender, hyaline apiculus much as in many species of *Grimmia.*

43. **Orthotrichum diaphanum** Brid. Musc. Recent. 2[2]: 29. 1801.

Orthotrichum canum Mitt. Jour. Linn. Soc. **8**: 26. 1864.

Tufts small, dense, 0.5–1 cm. high, grayish-green by reason of the hyaline leaf-tips, sparingly branched; leaves loosely imbricate, oblong-lanceolate to oblong-elliptic, sometimes bearing septate brood-bodies, mostly ending in a narrow, hyaline, rough hair-point which is longer in the upper and perichaetial leaves, about 2 mm. long, the margins revolute; costa ending in or below the apex; upper leaf-cells having walls little thickened, irregularly rounded-hexagonal, 14–20 μ in diameter, bearing simple papillae or nearly smooth, the basal cells rectangular, smooth, less dense, shorter on the margins; monoicous; seta short, $\pm$ 0.5 mm. long; capsules oblong-elliptic, immersed to emergent, 1.5–2 mm. long, light-colored, abruptly narrowed to the seta, smooth to faintly ribbed when dry (said to be strongly ribbed when old in European plants), then subcylindric; calyptra covering two-thirds of the capsule, nearly or quite naked; exothecial cells rather thin-walled, differentiated; stomata immersed, near the middle of the capsule; annulus present; operculum conic-rostellate; peristome double, the outer of 16 narrowly lanceolate teeth which are spreading to recurved when dry, sometimes split at the apex, strongly papillose with high, narrow papillae, reaching 0.3 mm. in length in European plants but mostly about 0.2 mm. in American, the segments 16, filiform, only a little shorter than the teeth and similarly papillose; spores rough, maturing in late winter and early spring.

TYPE LOCALITY: Europe.

DISTRIBUTION: On the base of trees; Texas, Arizona, and Colorado; Mexico; Europe; Asia; Africa.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. 219;* Husnot, Musc. Gall. *pl. 52;* Braithw. Brit. Moss-Fl. **2**: *pl. 56D;* Grout, Moss Fl. N. Am. **2**: *pl. 50C.*

EXSICCATI: Holz. Musci Acroc. Bor. Am. *492;* E. Bartr. Mosses So. Ariz. *57;* Grout, N. Am. Musci Perf. *366.*

NOTE: No specimens of Drummond's plants from "British America" are available; Mitten's type of *O. canum* cannot be found here or in England. The length and brittleness of the leaf awn vary greatly. The distinctive characters given by Mitten to separate *O. canum* do not seem to hold for any American plants. Sterile plants are likely to be mistaken for a *Grimmia.*

2. **ULOTA** Mohr; Brid. Musc. Recent. Suppl. 4: 112. 1819.*

Weissia Ehrh. Hannov. Mag. 17: 1003. 1779. Not *Weissia* Hedw. 1801.

Plants usually small, in dark green tufts, lighter above. Primary stems sometimes creeping and sending up a dense mass of short secondary stems, but usually the stems erect or ascending, 1–3 cm. long. Leaves lanceolate to ovate-lanceolate (except in *U. Hutchinsiae*, *U. Barclayi*, *U. Funstoni*), more or less keeled, the margins more or less revolute; costa strong, usually ending in the apex or just below it; upper leaf-cells small, thick-walled, rounded, nearly isodiametric, papillose; median basal cells smooth, elongate, often colored and sometimes with nodose walls; marginal basal cells shorter and more nearly hyaline. Perichaetial leaves scarcely differentiated. Monoicous (except *U. phyllantha*). Capsules well exserted, 8-ribbed when dry and empty, the neck mostly long and tapering. Calyptra conic-campanulate, plicate, lobed at the base, usually densely hairy. Annulus persistent. Stomata superficial, borne on the neck. Operculum hemispheric to conic, short-rostrate. Peristome like that of *Orthotrichum*, usually double.

Type species, *Ulota crispa* (Hedw.) Brid.

NOTE: *Ulota* approaches *Orthotrichum* through *U. americana;* also *Orthotrichum* subsect. *Pulchella* with its crispate leaves; but all these have immersed stomata.

Leaves not crisped when dry, scarcely contorted.
- Plants mostly rupestral; costa percurrent; leaves papillose. — 1. *U. Hutchinsiae.*
- Plants arboreal; costa ending below the apex; perichaetial leaves slightly differentiated.
  - Leaves with papillae; peristome-teeth finely papillose. — 9. *U. Barclayi.*
  - Leaves papillose; peristome-teeth coarsely and irregularly papillose with slender, salient papillae. — 10. *U. Funstoni.*

Leaves strongly contorted to crisped when dry.
- Many leaves nearly always tipped with clusters of septate brood-bodies; plants dioicous. — 8. *U. phyllantha.*
- Leaves not as above; plants monoicous.
  - Capsules smooth when dry except at the puckered mouth. — 5. *U. Ludwigii.*
  - Capsules strongly 8-ribbed throughout when dry.
    - Many leaves apiculate with a single cell or a linear aggregate of 2–9 cells; spores 30–60 μ in diameter. — 6. *U. megalospora.*
    - Leaves not apiculate; spores 15–30 μ in diameter.
      - Capsules not constricted below the mouth when dry (except occasionally in *U. obtusiuscula*).
        - Old capsules fusiform; peristome-segments narrowly linear. — 3. *U. Bruchii.*
        - Old capsules obconic-cylindric, always widest at the mouth; peristome-segments lanceolate. — 4. *U. obtusiuscula.*
      - Capsules constricted below the mouth when dry.
        - Leaves up to 2 mm. in length, with very large subcylindric papillae; peristome-teeth striate. — 7. *U. cirrata.*
        - Leaves up to 3 mm. in length, their papillae small or lacking; peristome-teeth finely papillose. — 2. *U. crispa.*

1. **Ulota Hutchinsiae** (Smith) Hammar, Monogr. Orthotr. Ulot. Suec. 27. 1852.

Orthotrichum americanum Beauv. Prodr. Aeth. 80. 1805.
Orthotrichum Hutchinsiae Smith, Eng. Bot. *pl. 2523.* 1814.
Orthotrichum strictum Brid. Bryol. Univ. 1: 289. 1826.
Weissia americana Lindb. Musci Scand. 28. 1879.
Ulota americana Limpr. in Rab. Krypt.-Fl. 4^2: 21. 1890. Not *U. americana* Mitt. 1864.

Plants dark green at the tips, dark purplish-brown to almost black below, 1–2 cm. high, rigid, brittle; leaves closely imbricate when dry, crowded, not contorted nor crisped, 1.5–2.5 mm. long, 0.4–0.6 mm. wide at the base, the upper narrower, concave-carinate, lanceolate to ovate-lanceolate or oblong-lanceolate, obtuse to obtusely acute, the margins more or less recurved; costa nearly or quite percurrent; upper leaf-cells papillose, very thick-walled, subcircular to elliptic, the lumen 8–10 μ in diameter; median basal cells strongly colored, very thick-walled, linear, the lumen often little wider than the walls; marginal basal cells with thinner walls, often also colored; seta 2–4 mm. long; capsules long-exserted, oblong-ovoid, the neck about 1 mm. long, the urn about 1.7 mm. long, pale yellowish-brown; old capsules sub-

* Credited by Bridel to "Web. Tab. Syn. Musc.", presumably Weber & Mohr, Tabula exhibens . . . . . Muscorum frondosorum genera (1813); this work has not been available.

cylindric and much darker in color, becoming strongly 8-ribbed when dry; calyptra very hairy; exothecial cells differentiated along the ribs; operculum conic-rostrate; peristome-teeth 16, united in pairs, finely papillose, erect at dehiscence, becoming reflexed later, perforate on the median line above; segments 8, slender, of two rows of cells, about half the length of the teeth; spores about 15 μ in diameter, maturing in early summer.

TYPE LOCALITY: Near Bantry, Eire.

DISTRIBUTION: On calcareous rocks, rarely on trees; eastern United States and Canada, south to Georgia, west to the Rocky Mountains; Arizona (*Bartram*); Europe.

ILLUSTRATIONS: B. S. G. Bryol. Eur. *pl. 226;* Braithw. Brit. Moss-Fl. **2**: *pl. 58D:* Husnot, Musc. Gall. *pl. 43;* O. Jennings, Mosses W. Pa. *pl. 15.*

EXSICCATI: Sull. Musci Allegh. *127;* Sull. & Lesq. Musci Bor. Am. *123;* ed. *2, 188;* Aust. Musci App. *157, 159;* Grout, N. Am. Musci Perf. *8.*

NOTE: Short capsules abruptly narrowed to the seta occur rarely, usually in the same tuft with normal capsules.

Ulota Hutchinsiae var. **rufescens** (E. G. Britton) Paris, Index Bryol. 1338. 1898. *Weissia americana* var. *rufescens* E. G. Britton, Bull. Torrey Club 21: 69. 1894. Plants more slender, green or brown; stems rufous-tomentose; leaves crowded, longer, narrower, acuminate; upper leaf-cells more dense and obscure, the lower golden-brown, rectangular, not linear nor sinuous, the marginal shorter, not hyaline; seta 2 mm. long; neck of the capsule tapering, 0.75 mm. long; urn pyriform, inflated, narrower at the mouth, the ribs continuous, of 3–6 rows of cells; calyptra with short, glossy, papillose hairs; stomata few, small. TYPE LOCALITY: Summit of White Top Mountain, on spruce trees in dense woods. DISTRIBUTION: White Top Mountain, Virginia; Great Smoky Mountains, North Carolina and Tennessee.

2. **Ulota crispa** (Hedw.) Brid. Musc. Recent. Suppl. **4**: 112. 1819.

Orthotrichum crispum Hedw. Sp. Musc. 162. 1801.
Ulota camptopoda Kindb. in Macoun, Cat. Can. Pl. **6**: 85. 1892.
Ulota crispa var. *subcalvescens* Card. & Thér. Proc. Wash. Acad. **4**: 310. 1902.
Ulota crispula Brid. Bryol. Univ. **1**: 793. 1827.
Ulota crispa var. *crispula* Hammar, Monogr. Orthotr. Ulot. Suec. 24. 1852.

Plants in small, dense tufts, yellowish-green above, brown below; stems 5–10 mm. long, sparingly branched; leaves strongly crisped when dry, about 2–3 mm. long, narrowly lanceolate from a broader, concave base, acute to narrowly obtuse, rather strongly papillose above, the margins plane; costa strong, vanishing in the apex; upper leaf-cells subcircular to transversely elliptic, very thick-walled, the lumen 8–10 μ thick; basal cells as described for the genus; seta 1–2 mm. long; capsules obovoid, well exserted, longer than the spore-sac, the neck long, slender, merging insensibly into the seta, together with neck and operculum about 2 mm. long, when dry suburceolate and contracted below the mouth immediately after dehiscence, abruptly contracted to the shrunken and wrinkled neck, 8-ribbed as to the spore-sac, this later shrinking and the entire capsule becoming narrowly subcylindric and deeply plicate; calyptra hairy; exothecial cells differentiated, rectangular along the bands; stomata just below the spore-sac; operculum conic-rostrate; peristome-teeth 16, at first more or less united in pairs, finely papillose and often perforate near the apex, reflexed when dry, 0.2 mm. long; segments 8, of two rows of cells, shorter than the teeth; spores finely papillose, up to 22 μ in diameter, maturing from late spring to early summer.

TYPE LOCALITY: Germany.

DISTRIBUTION: On rough bark of deciduous trees in moist regions; eastern United States and Canada, south to North Carolina and Tennessee, west to Minnesota; Alaska; Europe; Asia; Africa.

ILLUSTRATIONS: B. S. G. Bryol. Eur. *pl. 228;* Braithw. Brit. Moss-Fl. **2**: *pl. 59D;* Husnot, Musc. Gall. *pl. 43;* O. Jennings, Mosses W. Pa. *pl. 16;* Hedw. Descr. **2**: *pl. 33* [as *34*].

EXSICCATI: Sull. Musci Allegh. *29;* Sull. & Lesq. Musci Bor. Am. *125, 126;* ed. 2, *190;* Aust. Musci App. *158, 159;* Grout, N. Am. Musci Perf. *251.*

NOTE: The European plants of this species seem to be larger than the American, for Limpricht gives the height as 2 cm. and the length of the leaves as up to 3.6 mm.

Ulota crispa var. *crispula* is a form in which the shorter spore-sac does not shrink further at dehiscence; the neck seems much shorter than it really is. This has been collected in Florida.

Ulota crispa var. **intermedia** (Schimp.) Grout, Moss Fl. N. Am. **2**: 133. 1935. *Ulota intermedia* Schimp. Syn. ed. 2, 305. 1876. A large form with larger capsules, not contracted under the mouth when dry, becoming long-obconic-cylindric with age. TYPE LOCALITY: "Hassia superior," Germany. DISTRIBUTION: Ottawa; Miquelon Island; Europe. EXSICCATI: Macoun, Can. Musci *320;* Husnot, Musc. Gall. *763.*

Ulota crispa var. **alaskana** (Card. & Thér.) Grout, Moss Fl. N. Am. **2**: 134. 1935. *Ulota alaskana* Card. & Thér. Proc. Wash. Acad. **4**: 309. 1902. Plants yellowish-green at the tips, about 2 cm. high, larger than most North American plants of the species, but not larger than much of the

European material; lower leaves more abruptly narrowed from the obovate, concave base to a linear or narrowly lanceolate upper portion which is strongly keeled and slenderly acuminate, often very acute, the margins often strongly recurved just above the broad base, plane or somewhat revolute above; upper and perichaetial leaves broader above, occasionally narrowly obtuse; seta uniformly over 2 mm. long; capsules strongly resembling those of var. *intermedia* but somewhat contracted under the mouth when dry. TYPE LOCALITY: Gustavus, Glacier Bay, Alaska (*Coville & Kearney 774:* cotype seen). DISTRIBUTION: Alaska (*Coville & Kearney 407*). ILLUSTRATION: Proc. Wash. Acad. **4**: *pl. 15, f. 4 a–g.* NOTE: This variety is a robust form with a longer seta, the macroscopic differences greater than the microscopic.

3. **Ulota Bruchii** Hornsch.; Brid. Bryol. Univ. **1**: 794. 1826.

Orthotrichum dilatatum Bruch & Schimp. in B. S. G. Bryol. Eur. (**2–3**:) Orthotr. 22. 1837.

Strongly resembling *U. crispa*, but larger, darker below, reaching 2 cm. in length; leaves less strongly crisped, reaching 4 mm. or more in length, more acute, often abruptly widened and concave (ladle-shaped) at the base, there reaching 0.75 mm. in width; costa ending at or near the apex, scarcely roughened on the back above; upper leaf-cells papillose to nearly smooth, 12–14 μ in diameter; median basal cells linear-flexuous; seta 3–5 mm. long; capsules long-exserted, yellow, becoming dark brown with age, when dry short-oblong, always narrower at the mouth, 8-ribbed, the neck long and wrinkled, not contracted below the mouth, becoming progressively narrowly fusiform with age, without the neck about 1.5–2 mm. long, the neck nearly as long, bearing numerous stomata; calyptra hairy; operculum rostrate; peristome-teeth 0.3 mm. long; segments nearly as long as the teeth, linear but broader at the base; spores warty-papillose, 21–23 μ in diameter, maturing in summer.

TYPE LOCALITY: Germany.
DISTRIBUTION: On trees; Alaska; Europe.
ILLUSTRATION: B. S. G. Bryol. Eur. *pl. 227*.
NOTE: The only American specimen that seems to be this species was collected by Miss Grace Cooley at Juneau, Alaska, 5 Au 1889. The peristome-teeth are lighter-colored than those of typical plants. All other American plants referred to *U. Bruchii* appear to be *U. obtusiuscula.*

4. **Ulota obtusiuscula** C. Müll. & Kindb.; Macoun, Cat. Can. Pl. **6**: 82. 1892.

Very close to *U. Bruchii*, but differing consistently in the following particulars: leaves more generally very strongly papillose; costa roughened on the back near the apex by very large papillae; capsules never narrower at the mouth when old but rarely contracted under the mouth (as in specimens of *Macoun 453* in the Farlow Herbarium), 1.5 mm. long exclusive of the long neck; peristome-teeth 0.36–0.48 mm. long, more cancellate above; segments lanceolate, reaching half the width of the teeth at the base, irregularly dentate on the edges by the projecting ridges of the articulations; spores maturing in July.

TYPE LOCALITY: On small maple trees along the Coquilla River near New Westminster Junction, British Columbia.
DISTRIBUTION: On trees and shrubs; Washington, British Columbia, Alaska.
ILLUSTRATION: Grout, Moss Fl. N. Am. **2**: *pl. 57B*.
EXSICCATI: Macoun, Can. Musci *523* (type); Holz. Musci Acroc. Bor. Am. *523*.

5. **Ulota Ludwigii** Brid. Musc. Recent. Suppl. **4**: 112. 1819.

Orthotrichum Ludwigii Brid. Musc. Recent. Suppl. **2**: 6. 1812.

Plants in rather small tufts or cushions, green to brownish, 5–10 mm. high, erect to inclined, sparingly branched above by innovations; leaves somewhat twisted or crispate when dry, the upper 2–3 mm. long, narrowly lanceolate from a short, ovate, concave base (like the bowl of a spoon), narrowly obtuse to acute, the margins plane or slightly recurved; costa vanishing below the apex; upper leaf-cells small, 10–13 μ in diameter, slightly papillose with low, broad papillae, incrassate, subcircular to elliptic; median basal cells linear to oblong, very thick-walled; seta 3–6 mm. long; capsules including the neck and operculum about 2 mm. long, long-exserted, light brown, pyriform, smooth when dry except at the long neck and 8-plicate, puckered mouth; exothecial cells short, rounded, incrassate, not differentiated; peristome erect when dry, the 16 teeth united in pairs, finely papillose in vague patterns; segments rudimentary or wanting; spores papillose, about 15 μ in diameter, maturing in autumn.

TYPE LOCALITY: Germany.

DISTRIBUTION: On deciduous trees, preferably those with rough bark standing in the open; Newfoundland, eastern Canada, and the northeastern United States, south to North Carolina, west to Lake Superior; Europe.

ILLUSTRATIONS: Schwaegr. Suppl. 1[2]: *pl. 51;* B. S. G. Bryol. Eur. *pl. 225;* Braithw. Brit. Moss-Fl. 2: *pl. 58;* Husnot, Musc. Gall. *pl. 43;* O. Jennings, Mosses W. Pa. *pl. 15.*

EXSICCATI: Drummond, Musci Am. *146;* Sull. & Lesq. Musci Bor. Am. *124;* ed. 2, *189;* Aust. Musci App. *156;* Holz. Musci Acroc. Bor. Am. *275;* Grout, N. Am. Musci Perf. *261.*

NOTE: All American plants referred to *Weissia coarctata* (Beauv.) Lindb. are *U. Ludwigii. Orthotrichum coarctatum* Beauv. is doubtfully a synonym.

6. **Ulota megalospora** Venturi; Röll, Bot. Centr. 44: 389. 1890.

Ulota subulifolia C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 82. 1892.
Ulota subulata C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 82. 1892.

Plants bright green, growing in dense tufts, often spreading by creeping primary stems, freely divided and branching above with numerous short branches, the erect portions reaching 1 cm. or more; leaves crisped when dry, 1–2 mm. long, narrowly lanceolate from a short, ovate, concave (spoon-shaped) base, carinate above, mostly filiform-acuminate, the apex often of a linear aggregate of 1–9 elongate cells; perichaetial leaves acute to narrowly obtuse, the margins plane or somewhat recurved below; costa ending in the apex; upper leaf-cells very thick-walled, irregular and nearly isodiametric or somewhat elongate, 7–10 μ in the shortest diameter, 15 μ in the longest, papillose with simple, low papillae; median basal cells linear, incrassate, soon shorter above and grading into those of the upper leaf; seta up to 4 mm. in length; capsules long-exserted, pyriform with a slender, tapering neck, about 1.5 mm. long including the neck, when dry deeply 8-ribbed, brown, becoming darker and subcylindric with age, slightly or not at all contracted under the mouth; calyptra sparsely hairy; exothecial cells differentiated; operculum hemispheric, rostellate; peristome-teeth 16, united in pairs, pale, finely papillose, the papillae more or less in irregular lines, reaching 0.24 mm. in length, more or less perforate along the middle line above, at first erect, reflexed when old and dry; segments 8, linear; spores maturing in summer, very large, 30–45 μ or even 60 μ in diameter, coarsely papillose.

TYPE LOCALITY: Riga, near Clealum Lake, Washington.

DISTRIBUTION: On trees; British Columbia, Washington, Idaho.

ILLUSTRATION: Grout, Moss Fl. N. Am. 2: *pl. 57C.*

EXSICCATI: Drummond, Musci Am. *153* (in part); Allen, Mosses Cascade Mts. *38;* Holz. Musci Acroc. Bor. Am. *522.*

NOTE: In general appearance this species strongly resembles *U. crispa*, but the filiform-acuminate leaves and gigantic spores easily identify it. I do not find the small (15 μ) or the very large spores reported by Venturi in the type, and the spores are almost warty rather than finely papillose.

Drummond's *153* is rather poorly characterized and the N. Y. Bot. Garden specimen contains *U. cirrata.*

7. **Ulota cirrata** (Bernh.) Grout, comb. nov.

Orthotrichum cirratum Bernh.; Weber & Mohr, Bot. Tasch. 237. 1807. Not *Weissia cirrata* Hedw. 1801.
Orthotrichum curvifolium Wahl. Fl. Lapp. 365. 1812.
Ulota curvifolia Brid. Bryol. Univ. 1: 312. 1826.
Ulota americana Mitt. Jour. Linn. Soc. 8: 26. 1864. Not *U. americana* Beauv. 1805.
Ulota scabrida Kindb.; Macoun, Cat. Can. Pl. 6: 83. 1892.

Plants yellowish-green at the tips, brown to almost black below, robust; primary stems creeping, the secondary erect, 1–2.5 cm. high, branched above, stiff; leaves spreading to recurved, moderately crisped when dry, short, ± 2 mm. long, lanceolate from an ovate-concave base which is $\frac{1}{4}$–$\frac{1}{3}$ the length of the leaf, keeled, mostly narrowly obtuse, papillose above on both sides and on the costa with very high, rather slender papillae, the margins more or less recurved (very broadly so); costa strong, ending just below the apex; upper leaf-cells very thick-walled, the lumen 7–10 μ in diameter; median basal cells linear, the walls nearly or quite the thickness of the lumen, bright golden-brown; extreme angular cells colored and somewhat inflated, above them the usual short hyaline cells; seta 2 mm. or more long; capsules light brown, pyriform, narrower at the mouth, darker and subcylindric when old; calyptra hairy; exothecial cells strongly differentiated along the 8 ribs; operculum conic-rostrate; peristome-teeth 16, more or less united in pairs, striate, 0.24 mm. long; segments linear, of 2 rows of cells, as long as the teeth; spores 15–20 μ in diameter, papillose, maturing in summer.

TYPE LOCALITY: Erfurt, Germany.
DISTRIBUTION: On noncalcareous rocks, alpine or boreal; British Columbia; upper Canada; Newfoundland; Labrador; Ontario, near Lake Huron; Europe.
ILLUSTRATIONS: B. S. G. Bryol. Eur. *pl. 226;* Broth. Laubm. Fennosk. 370; Husnot, Musc. Gall. *pl. 43.*
EXSICCATI: Drummond, Musci Am. *153* (in part).

8. **Ulota phyllantha** Brid. Musc. Recent. Suppl. 4: 113. 1819.

Orthotrichum phyllanthum Steud. Nom. Bot. Crypt. 304. 1824.
Orthotrichum jutlandicum Brid. Bryol. Univ. 1: 296. 1826.
Orthotrichum fasciculatum Brid. Bryol. Univ. 1: 297. 1826.
Weissia phyllantha Lindb. Musci Scand. 28. 1879.
Ulota maritima C. Müll. & Kindb. in Macoun, Cat. Can. Pl. 6: 84. 1892.

Plants in dense thick tufts, brownish-green to yellowish-green above, dark brown below, 1–3 cm. high, simple or sparingly branched; leaves long-lanceolate to linear-lanceolate, very strongly crispate when dry, reaching 3 mm. or more in length, slender-pointed, narrowly obtuse to acute, the margins more or less revolute below, mostly plane above; costa stout, vanishing in the apex, or in some of the upper leaves usually excurrent into a thick point bearing numerous oblong-cylindric, septate brood-bodies; upper leaf-cells strongly papillose, very thick-walled, irregularly rounded, subcircular to elliptic, the lumen 7–8 μ in diameter, the walls fully half as thick; median basal cells linear, colored, very thick-walled; dioicous; seta light red-brown, reaching 1 cm. in length, usually less; capsules exserted much beyond the leaves when just mature and operculate, brown to light yellow, when dry oblong-ovoid with a long, wrinkled neck, scarcely contracted below the mouth, slightly ribbed, when old and dry oblong-cylindric, strongly ribbed and darker in color, the urn about 1.5 mm. in length exclusive of the neck; calyptra sparingly hairy; exothecial cells slightly differentiated; peristome-teeth 16, at first erect when dry, later reflexed, at first united in pairs, having 18–20 rectangular, finely papillose, external plates, somewhat colored; segments 8, about 0.4 mm. long, linear; spores maturing in early summer.

TYPE LOCALITY: Schleswig, Germany.
DISTRIBUTION: On rocks or trees; Pacific Coast region from Oregon to Unalaska; also reported from Newfoundland, Miquelon Island. Nova Scotia.
ILLUSTRATIONS: B. S. G. Bryol. Eur. *pl. 223;* Braithw. Brit. Moss-Fl. 2: *pl. 59E.*
EXSICCATI: Holz. Musci Acroc. Bor. Am. *188;* Allen, Mosses Cascade Mts. *39.*
NOTE: None of the distinctions given for *U. maritima* will hold, though *U. phyllantha* varies in all the characters given for *U. maritima.* The majority of the rock-growing plants, especially those near the sea, are shorter, less yellow, with shorter, less attenuate leaves, and shorter (2 mm.) seta. In the fruiting plants the brood-bodies are sometimes lacking. The dark leaf-tips covered with brood-bodies are discernible with a hand-lens. See Bull. Torrey Club 21: 72, 73. 1894; Dixon, Handb. ed. 3, 267.

9. **Ulota Barclayi** Mitt. Jour. Linn. Soc. 8: 26. 1864.

Plants very small, 5–8 mm. high, slender; leaves not crisped, irregularly appressed-imbricate when dry, erect-spreading when moist, the lower narrowly lanceolate-acuminate from an ovate or obovate, concave base, slenderly acute at the apex, the upper larger, sometimes reaching 2 mm. in length, broadly lanceolate, the subsheathing perichaetial leaves broadly acute to rounded-obtuse, the margins plane; costa stout, ending below the apex; upper leaf-cells not papillose but somewhat bulging, thick-walled, irregularly subcircular, the lumen about 7 μ in diameter, the walls 2–3 μ thick; median basal cells yellow, linear, very thick-walled; hyaline marginal cells in a wider band than usual; autoicous; seta 2 mm. long; capsules well exserted, ovoid, the neck 2 mm. long, resembling that of *Trematodon*, the neck and capsule strongly 8-ribbed when dry and shrunken, subcylindric, slightly contracted under the wider mouth; calyptra slightly hairy; stomata numerous in the upper neck and about the base of the spore-sac; exothecial cells strongly differentiated in alternating bands, one of wide, rectangular cells with incrassate longitudinal walls, the other of much narrower and indistinct cells; peristome-teeth in 8 pairs, reflexed against the wall of the capsule when dry, densely and minutely papillose; segments 8, filiform, erect when dry, of 2 rows of cells, nearly as long as the teeth but very fragile.

TYPE LOCALITY: Sitka, Alaska.
DISTRIBUTION: Sitka and Yakutat Bay, Alaska.
ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 56*.
NOTE: Sullivant remarks (Ic. Musc. Suppl. 75) that this is very near to or conspecific with *Orthotrichum japonicum* Sull. & Lesq. from Japan. Neither Mitten nor later authors emphasize sufficiently the differentiated perichaetial leaves. Piper's plants from the bark of birch or alder perhaps show this more clearly than the type, which I have not seen.

10. **Ulota Funstoni** Grout, Moss Fl. N. Am. **2**: 137. 1935.

Plants small, 5–10 mm. high, little branched; leaves slightly contorted and imbricate when dry, erect-spreading when moist, the lower ± 1.2 mm. long, narrowly lanceolate from an ovate, concave base, acute to obtuse, the upper and perichaetial 2–2.3 mm. long, 0.7 mm. broad at the base, ovate-lanceolate, broadly obtuse, often concave at the apex, the margins mostly plane, often somewhat recurved near the base; costa strong, ending below the apex; upper leaf-cells multiform, subcircular to elliptic, very thick-walled, irregularly rounded, the lumen 6–10 μ in diameter, more or less papillose with low, broad papillae; basal cells smooth, the median oblong to linear, colored, the basal marginal shorter but the hyaline marginal band narrower or lacking; autoicous; antheridial buds in the axils of the upper leaves; seta 3–4 mm. long; capsules long-exserted, pyriform-clavate, the neck long, slender, 2.4 mm. long, strongly 8-ribbed and somewhat contracted below the mouth when dry and empty, when old subcylindric; exothecial cells in alternating strips of oblong-rectangular and subcircular to short-oblong cells; stomata numerous, superficial, near the base of the spore-sac; operculum conic-rostrate; peristome-teeth 16, reflexed when dry, slender, 0.25–0.35 mm. long, perforate and trabeculate above, pale, darker at the base, papillose with large, slender papillae, 1–2 μ in height; segments not seen, either lacking or very fragile (operculate capsules were studied); spores about 20 μ in diameter, maturing in summer.

TYPE LOCALITY: Vicinity of Yakutat Bay, Alaska (*Frederick Funston 158*).
DISTRIBUTION: Alaska (*Piper 2369a*).
ILLUSTRATION: Grout, Moss Fl. N. Am. 2: *pl. 57A*.
NOTE: See Grout, Moss Fl. N. Am. 2: 138. *U. Funstoni* is possibly a derivative of *U. Hutchinsiae*, from which it is distinguished by its lighter color, larger perichaetial leaves, more coarsely papillose and less paired peristome-teeth, and larger spores, as well as by the arboreal habitat. Or may it be a hybrid?

DOUBTFUL SPECIES

"ULOTA PLICATA (Beauv.) Brid." from Newfoundland (*La Pylaie*) is without doubt a misidentification.

ULOTA DRUMMONDI (Hook. & Grev.) Brid. Bryol. Univ. 1: 299. 1826. No American specimens of this species are known. It differs from *U. Bruchii* and *U. crispa* in the slightly contorted leaves and much more numerous stomata.

3. **AMPHIDIUM** Schimp. Coroll. Bryol. Eur. 39. 1856; nomen conservandum propositum. Not *Amphidium* Nees. 1819.

Anictangium Hedw. Sp. Musc. 40. 1801.
Amphoridium Schimp. Syn. 247. 1860.

Plants in dense, soft tufts or cushions, often of considerable extent, dark green to yellowish-green, brown below. Stems more or less branched, radiculose, evenly foliate, without a central strand. Leaves narrowly lanceolate, papillose on both sides with low papillae, contorted to crispate when dry; costa nearly or quite percurrent, with median guides; upper leaf-cells incrassate, more or less rounded-quadrate to rounded-hexagonal, often dense; basal leaf-cells rectangular, less incrassate, hyaline or somewhat colored, smooth. Perichaetial leaves more or less sheathing, more or less differentiated, the elongate, smooth cells extending higher. Autoicous or dioicous. Seta erect or slightly curved, gradually enlarged to the long neck of the capsule. Capsules mostly erect and symmetric, emergent to exserted, pyriform, strongly 8-ribbed and often urceolate and contracted below the mouth when dry and empty. Calyptra smooth, cucullate, plicate. Exothecial cells differentiated along the ribs; mouth of the capsule

bordered by several rows of smaller cells. Stomata superficial, in the neck of the capsule. Annulus and peristome lacking.

Type species, *Amphidium lapponicum* (Hedw.) Schimp.

NOTE: Although Brotherus (E. & P. Nat. Pfl. ed. 2, 10: 192) puts *Amphidium* in the Rhabdoweisioideae of the Dicranaceae, it seems to the writer that its alliances are much more clearly with *Ulota* and *Orthotrichum*. The smooth, cucullate calyptra is the only character at variance with this position. This also occurs in *Drummondia*, but the peristome in that genus helps to indicate its affinities.

Leaves entire.
- Autoicous; leaf-margins plane; perichaetial leaves entirely smooth, not papillose above. — 1. *A. lapponicum.*
- Dioicous; leaf-margins more or less recurved; perichaetial leaves papillose near the apex. — 2. *A. Mougeotii.*

Leaves distantly toothed. — 3. *A. californicum.*

1. **Amphidium lapponicum** Schimp. Coroll. Bryol. Eur. 39. 1856.

Anictangium lapponicum Hedw. Sp. Musc. 40. 1801.
Anictangium striatum Brid. Musc. Recent. Suppl. 1: 25. 1806.
Zygodon lapponicus Bruch & Schimp. in B. S. G. Bryol. Eur. (4:) Zyg. 6. 1838.
Amphoridium lapponicum Schimp. Syn. 247. 1860.

Plants cespitose, dark green, brown to blackish below, 1–3 cm. high; leaves more or less crisped when dry, spreading when moist, 1.5–2 mm. long, narrowly oblong-lanceolate to linear-lanceolate, sharply to obtusely acute at the apex, the margins plane, entire; costa strong, ending shortly below the apex, with 4 median guide cells; lamina mostly of one layer of cells; upper median leaf-cells roundish-quadrate, incrassate, 8–10 μ in diameter, papillose on both sides with numerous low papillae; basal cells smooth, larger, rectangular, thinner-walled, pellucid to hyaline; perichaetial leaves very different, sheathing, entirely smooth, the upper more abruptly acuminate, often serrate at the base of the acumination, the upper cells elongate in all, rhomboidal to rhombic; autoicous; seta about 1.5 mm. long; capsules pyriform, about half-emergent, erect and symmetric, brownish and 8-ribbed when dry, more or less urceolate with a spreading mouth, the neck distinct, as long as the spore-sac; calyptra covering about half the capsule; operculum red, the beak usually less than the radius of the capsule; spores 10–12 μ in diameter, maturing in spring or early summer.

TYPE LOCALITY: Lapland.

DISTRIBUTION: Crevices of cool, moist, shaded ledges and cliffs in elevated regions, mostly on noncalcareous rocks; Greenland to British Columbia, south to California and Arizona, and the northern United States east of the Rocky Mountains; Europe; Asia.

ILLUSTRATIONS: B. S. G. Bryol. Eur. *pl. 296;* Braithw. Brit. Moss-Fl. **2**: *pl. 53E;* Husnot, Musc. Gall. *pl. 42;* Rab. Krypt.-Fl. **4**^{2}: *f. 212;* Grout, Moss Fl. N. Am. **2**: *pl. 59B.*

EXSICCATI: Drummond, Musci Am. *28* (as *Gymnostomum*); Sull. & Lesq. Musci Bor. Am. *115;* ed. 2, *171;* Aust. Musci App. *154;* Holz. Musci. Acroc. Bor. Am. *239, 451, 63* (as *A. Mougeotii*); E. Bartr. Mosses S. Ariz. *166;* J. A. Allen, Mosses Cascade Mts. *36;* Grout, N. Am. Musci Perf. *111.*

Amphidium lapponicum var. **crispatum** (Kindb.) Grout, Moss Fl. N. Am. **2**: 139. 1935. *Zygodon crispatus* Kindb. Rev. Bryol. **23**: 21. 1896. Plants slender, light-colored, with the appearance of *A. Mougeotii;* leaves more distant, their bases more sheathing, their apices very sharply acute ("acicular"). TYPE LOCALITY: On rocks near Revelstoke, British Columbia (*Macoun*). DISTRIBUTION: Known only from the type locality. NOTE: A specimen from the type locality has been studied. The leaf margins are less recurved and the cell structure is that of *A. lapponicum.*

2. **Amphidium Mougeotii** (Bruch) Schimp. Coroll. Bryol. Eur. 40. 1856.

Gymnostomum Mougeotii Bruch; Hübener, Musc. Germ. 59. 1833.
Zygodon Mougeotii Bruch & Schimp. in B. S. G. Bryol. Eur. (4:) Zyg. 7. 1838.
Amphoridium Mougeotii Schimp. Syn. 248. 1860.
Anoectangium Mougeotii Lindb. Musci Scand. 29. 1879.
Zygodon decipiens Kindb. Eur. & N. Am. Bryin. 317. 1897.

Plants in dense tufts, yellowish-green above; stems more slender than in *A. lapponicum*, 2–6 cm. high (occasionally reaching 10 cm.), dichotomously branching; leaves more distant, spreading to erect-spreading, somewhat crisped when dry, reaching 3 mm. in length, narrowly linear-lanceolate, gradually and slenderly acuminate, the margins entire, mostly recurved on one or both sides from about the middle of the leaf to the subsheathing base; costa strong,

ending near the apex, with 2–4 guide cells; upper median leaf-cells less regular and more incrassate than in the preceding species, mostly rounded-quadrate, the papillae less distinct; basal cells smaller, more incrassate and colored; perichaetial leaves much less strongly differentiated than in the preceding species, sheathing only at the base, scarcely different from the stem leaves except in the apical cells which are more elongate; elongate median and basal cells very incrassate; dioicous; capsules barely exserted on a seta 2–3 mm. long, short-pyriform, when dry 8-ribbed, little or not at all contracted under the mouth when dry, subcampanulate; beak of the operculum equal to the radius of the capsule; spores maturing in summer or late autumn.

TYPE LOCALITY: Vosges Mountains, France.

DISTRIBUTION: On damp shaded rocks, usually noncalcareous, in cool elevated regions, rare and seldom fruiting; Newfoundland to Alaska, south to Alabama and Oregon; Europe; Asia.

ILLUSTRATIONS: B. S. G. Bryol. Eur. *pl. 296;* Braithw. Brit. Moss-Fl. **2**: *pl. 53F;* Grout, Moss Fl. N. Am. **2**: *pl. 59A*.

EXSICCATI: Sull. & Lesq. Musci Bor. Am. ed. 2, *170;* Aust. Musci App. *155;* Macoun, Can. Musci *420, 405;* Ren. & Card. Musci Am. Sept. Exs. *174*.

3. **Amphidium californicum** (Hampe) Broth. in E. & P. Nat. Pfl. **1**[3]: 460. 1902.

Zygodon californicus Hampe; C. Müll. Bot. Zeit. **20**: 361. 1862.
Didymodon caespitosus Mitt. Jour. Linn. Soc. **8**: 18. 1864.
Amphoridium californicum Jaeger, Ber. St. Gall. Nat. Ges. **1871–1872**: 385. 1873.
Amphoridium caespitosum Jaeger, Ber. St. Gall. Nat. Ges. **1871–1872**: 385. 1873.

Plants reaching 3–4 cm. high, slender, often much branched above; leaves crisped when dry, erect-spreading from a subsheathing base when moist, long-linear-lanceolate, 3–4 mm. long, slenderly acuminate, canaliculate-carinate, the margins (of most leaves) irregular in outline to distinctly toothed, more or less recurved near the base on one side at least; costa strong, vanishing in the apex; upper leaf-cells rounded-quadrate, incrassate, about 9 μ in diameter, with very low, inconspicuous papillae, gradually changing to the smooth, more elongate, more translucent, rectangular basal cells, which are thinner-walled and more elongate at the margin near the insertion; perichaetial leaves sheathing in the lower half only, not much differentiated, longer than the capsule and seta; dioicous; antheridial plants intermixed with the archegonial; capsules ovoid-pyriform, the neck shorter than in the preceding species, often inclined by the curving of the seta, 8-ribbed when dry and contracted below the mouth, which is scarcely narrowed in drying, the urn about 1 mm. long; operculum conic-apiculate; spores rarely produced.

TYPE LOCALITY: San Jose Valley, California.

DISTRIBUTION: On shaded rocks; Southern California to Vancouver Island; Cape Breton, Nova Scotia.

ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl. 32*.

EXSICCATI: Sull. & Lesq. Musci Bor. Am. ed. 2, *172;* Macoun, Can. Musci *307* (as *Amphidium caespitosum*), *307a* (as *Zygodon Sullivantii* Lesq. & James); Holz. Musci Acroc. Bor. Am. *240, 626, 342* (as *Amphidium caespitosum*).

NOTE: The serration and the recurving of the margins is exceedingly variable; on some leaves of some specimens the margin may be plane and entire, while other leaves are characteristic.

4. **ZYGODON** Hook. & Tayl. Musc. Brit. 70. 1818.

Amphidium Nees in Sturm, Deuts. Fl. Crypt. **5**(17): 2. 1819.
Codonoblepharon Schwaegr. Suppl. **2**[1]: 142. 1824.
Amphoridium Schimp. Syn. 247, in part. 1860.

Plants in wide, dense, dark green tufts or cushions, brown to blackish below, lighter green above, often densely radiculose below with papillose radicles. Stems slender, erect to ascending, usually branching freely, densely foliate, without a central strand. Multicellular broodbodies present in most species. Leaves contorted-appressed when dry, spreading to recurved when moist, oblong to linear-lanceolate, acute, narrowly obtuse, or even lingulate and rounded-obtuse, the margins mostly plane but the leaves often deeply carinate, entire, or less often serrate at the apex; costa strong, ending in or below the apex (excurrent in *Z. pungens*); upper leaf-cells small, obscure, irregularly rounded, mostly incrassate and papillose; basal cells larger, more elongate, often rectangular and translucent. Perichaetial leaves usually little differentiated, not sheathing. Seta mostly erect, usually from a short lateral branch. Capsules erect, symmetric, or rarely somewhat arcuate, pyriform to cylindric, 8-plicate and more or less

narrowed under the mouth, with a stoma-bearing neck 1–1½ times the length of the urn. Calyptra small, smooth, rarely somewhat hairy. Stomata superficial. Annulus inconspicuous or lacking. Operculum long-conic to rostrate. Peristome double, single, or lacking.

Type species, *Zygodon conoideus* (Dicks.) Hook. & Tayl.

Leaf-cells papillose; costa not excurrent.
  Leaves oblong-lanceolate to linear-lanceolate, broadly to narrowly acute (Sect. 1. *Euzygodon*).
    Leaves typically entire, rarely with a few short teeth near the apex.
      Leaves not undulate.
        All leaves entire and sharply acute, mostly tipped with a single long, clear cell.
          Leaves erect-open when moist; brood-bodies mostly fusiform, 5–7-celled; peristome double. 1. *Z. conoideus.*
          Leaves recurved to squarrose when moist; brood-bodies 3–5-celled; peristome lacking. 2. *Z. viridissimus.*
        Some leaves slightly toothed at the apex, mostly broadly acute. 4. *Z. Liebmanni.*
      Leaves more or less undulate when moist, very acute, rarely toothed. 5. *Z. Ehrenbergi.*
    Leaves sharply serrate in the upper part.
      Leaves loosely spreading when moist, undulate and not very brittle. 3. *Z. Reinwardti.*
      Leaves strongly squarrose when moist, strongly carinate and very brittle. 6. *Z. campylophyllus.*
  Leaves lingulate, broadly rounded-obtuse (Sect. 2. *Obtusifolii*). 7. *Z. obtusifolius.*
Leaf-cells smooth; costa excurrent (Sect. 3. *Bryoides*). 8. *Z. pungens.*

Section 1. Euzygodon C. Müll. Syn. 1: 671. 1849. Not *Euzygodon* Juratzka, as genus, 1882. Leaves linear-lanceolate to oblong-lanceolate, acute; upper leaf-cells papillose; peristome single, double, or lacking.

1. **Zygodon conoideus** (Dicks.) Hook. & Tayl. Musc. Brit. 71. 1818.

Bryum conoideum Dicks. Pl. Crypt. Brit. 4: 9. 1801.
Zygodon Brebissoni Bruch & Schimp. in B. S. G. Bryol. Eur. (4:) Zyg. 8. 1838.

Plants rather small and slender; brood-bodies of a single row of 5–7 cells; leaves appressed and little contorted when dry, scarcely recurved when moist, broadly lanceolate, rather abruptly subulate and ending in a single long, clear cell, the margins plane and entire; costa ending several cells below the apex; leaf-cells reaching 15 μ in diameter but these mixed with smaller ones, less obscure than in most other species with papillose leaves; dioicous; seta about 7 mm. long; capsules pyriform, the neck nearly as long as the urn; peristome double, fugacious, the 16 outer teeth united in pairs, about 0.1 mm. long; segments 8, linear, delicate, shorter than the teeth.

TYPE LOCALITY: Near Inverary, Scotland.

DISTRIBUTION: On the bark of trees; Nova Scotia (*Margaret Brown*); Newfoundland (*Waghorne*); widely distributed in Europe.

ILLUSTRATIONS: Hook. & Tayl. Musc. Brit. *pl. 3, 21;* Dicks. Pl. Crypt. Brit. 4: *pl. 11, f. 2;* B. S. G. Bryol. Eur. *pl. 207* (as *Z. Brebissoni*); Braithw. Brit. Moss-Fl. 2: *pl. 54D;* Dixon, Handb. ed. 3, *pl. 31I;* Grout, Moss Fl. N. Am. *pl. 59D;* Latv. Bot. Darza Darbi 1: *f. 50, 51, 54.*

EXSICCATI: Grout, N. Am. Musci Perf. *288.*

2. **Zygodon viridissimus** (Dicks.) Brid. Bryol. Univ. 1: 592. 1826.

Bryum viridissimum Dicks. Pl. Crypt. Brit. 4: 9. 1801.
Dicranum viridissimum Smith, Fl. Brit. 1224. 1804.
Gymnostomum viridissimum Smith, Engl. Bot. *pl. 1583.* 1806.
Amphoridium viridissimum De-Not. Atti Univ. Genova 1: 277. 1869.

Plants in small, bright green tufts or cushions 1–2 cm. high; stems erect or ascending, tomentose with more or less papillose radicles, which often bear 4- or 5-celled, clavate brood-bodies; leaves close, somewhat twisted and contorted when dry, spreading and recurved when moist, 1–2 mm. long, linear-lanceolate to oblong-lanceolate, acuminate and often subulate at the apex and ending in 1 or 2 single elongate cells, carinate, the margins plane and entire; costa vanishing below the apex; upper median leaf-cells rounded, thick-walled, papillose on both sides, 8–11 μ in diameter; basal cells short-rectangular, rounded at the angles, incrassate, smooth; small, clavate, jointed brood-bodies of 3–5 cells often found on the leaves and in the axils; inner perichaetial leaves smaller, their basal cells nearly linear; dioicous; seta 3–7 mm.

long, terminal, becoming lateral by innovations; capsules elongate-pyriform, 1.5–2 mm. long, 8-ribbed when dry and empty, contracted at the mouth; calyptra fugacious; operculum obliquely rostrate; annulus and peristome lacking; spores rough, 13–16 μ in diameter, maturing in summer.

TYPE LOCALITY: England.

DISTRIBUTION: Mostly on trees; Hudson Bay; northern New York, south to Georgia; Washington; Arizona; Europe; Macronesia; North Africa; Asia Minor; the Caucasus.

ILLUSTRATIONS: B. S. G. Bryol. Eur. *pl. 206;* Dicks. Pl. Crypt. Brit. *pl. 10, f. 18;* Mem. Torrey Club **4**: *pl. 80;* Braithw. Brit. Moss-Fl. 2: *pl. 54C;* Bryologist **11**: *pl. 6;* Grout, Moss Fl. N. Am. **2**: *pl. 59C;* Latv. Bot. Darza Darbi **1**: *f. 2f, 11, 12. pl. 1.*

NOTE: See Bryologist 11: 61–66.

Zygodon viridissimus var. **rupestris** Lindb.; Hartm.f. in Hartm. Skand. Fl. ed. 9, 2: 52. 1864. *Zygodon rupestris* Lindb.; Hartm. f. in Hartm. Skand. Fl. ed. 9, 2: 52, as synonym. 1864. *Zygodon viridissimus* var. *vulgaris* Malta, Acta Univ. Latv. 9: 121. 1924. Plants more robust, the leaves averaging longer and narrower; subulate apex of the leaves rather longer and more slender, the apical cell longer. TYPE LOCALITY: Scandinavia. DISTRIBUTION: Usually on calcareous rocks; Hudson Bay; Vancouver Island; Cascade Mountains; Alaska; Virginia (*Patterson R 504*). EXSICCATI: Drummond, Musci Am. *27;* J. A. Allen, Mosses Cascade Mts. *46;* Macoun, Can. Musci *303*. NOTE: Malta suggests that all American plants probably belong to this variety, but specimens from both sides of the continent seem to be of the typical form (e.g. *Grout* from North Carolina, *Bartram 866B* from Arizona).

Zygodon viridissimus var. **rufo-tomentosus** (E. G. Britton) Grout, comb. nov. *Zygodon rufo-tomentosus* E. G. Britton; Paris, Index Bryol. ed. 2, 5: 141. 1906 (nomen nudum); Malta, Latv. Bot. Darza Darbi 1: 54. 1926. Stems densely reddish-tomentose; capsules cylindric, the neck long. TYPE LOCALITY: Virginia. DISTRIBUTION: Mountains of the eastern United States, from the Adirondacks to Georgia and Tennessee. ILLUSTRATION: Latv. Bot. Darza Darbi 1: *f. 19*. NOTE: Malta treats this as a species because of its longer, cylindric capsule.

3. **Zygodon Reinwardti** (Hornsch.) A. Br.; Bruch & Schimp. in B.S.G. Bryol. Eur. (4:) Zyg. 9. 1838.

Syrrhopodon Reinwardti Hornsch.; Reinw. & Hornsch. Nova Acta Acad. Leop.-Carol. 14^2: 700. 1829.
Zygodon Moritzianus C. Müll. Linnaea **19**: 199. 1847.
Zygodon denticulatus Tayl. Lond. Jour. Bot. **6**: 329. 1847.
Zygodon cylindricarpus C. Müll. Bot. Zeit. **11**: 59. 1853.
Zygodon subdenticulatus Hampe; Triana & Planch. Ann. Sci. Nat. V. **4**: 326. 1865.
Zygodon andinus Mitt. Jour. Linn. Soc. **12**: 236. 1869.
Zygodon circinatus Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 187. 1872.
Zygodon breviciliatus Thw. & Mitt.; Mitt. Jour. Linn. Soc. **13**: 304. 1873.
Zygodon Glaziovii Hampe; Warming, Vidensk. Meddel. **1874**: 142. 1875.
Zygodon ceratodontoides C. Müll. Flora **58**: 535. 1875.
Zygodon caldensis Ångstr. Oefv. Sv. Vet.-Akad. Förh. 33^4: 15. 1876.
Zygodon Fendleri C. Müll. Linnaea **42**: 485. 1879.
Zygodon gymnus C. Müll. Linnaea **42**: 485. 1879.
Zygodon borbonicus Besch. Ann. Sci. Nat. VI. **9**: 353. 1879.
Zygodon Hyadesi Besch. Bull. Soc. Bot. Fr. **32**: LX. 1885.
Zygodon paucidens C. Müll. Nuov. Giorn. Bot. Ital. II. **4**: 120. 1897.
Zygodon Volkensii Broth. Bot. Jahrb. **24**: 241. 1897.
Zygodon dives C. Müll. Bull. Herb. Boiss. **6**: 94. 1898.
Zygodon capillicaulis C. Müll. Bull. Herb. Boiss. 6: 94. 1898.
Zygodon argutidens Broth. in Mildbraed, Wiss. Erg. Deuts. Zent.-Afr. Exp. **2**: 148. 1914.

Stems up to 2 cm. long, dichotomously branching; brood-bodies of various shapes; leaves contorted-appressed when dry, widely spreading to subsquarrose when moist, up to 2 mm. or more in length, oblong-lanceolate, decurrent, sharply acute, often ending in a single smooth, much elongate cell, the margins plane, usually more or less undulate, near the apex sharply dentate-serrate (rarely nearly entire); costa ending in or below the apex; upper leaf-cells roundish to irregularly hexagonal, incrassate, strongly papillose, 9–12 μ in diameter; basal cells rectangular, smooth, not obscure; inner perichaetial leaves often ovate-lanceolate, entire; synoicous, but the antheridia and archegonia often separated; seta up to 2 cm. long; capsules oblong to cylindric, erect to somewhat arcuate, the urn up to 3 mm. long; calyptra smooth; operculum long-rostrate; peristome inserted below the mouth of the capsule, of 16 slender, rudimentary endostome segments (cilia of authors); spores papillose, 21–28 μ in diameter.

TYPE LOCALITY: Java (*Reinwardt*).

DISTRIBUTION: On the bark of trees, less frequently on rocks; almost world-wide but largely in the warmer regions; Mexico to Patagonia; Brownson Bay, Alaska (*T. C. Frye*).

ILLUSTRATIONS: Schwaegr. Suppl. 4: *pl. 312;* Latv. Bot. Darza Darbi 1: *f. 68;* Nova Acta Acad. Leop.-Carol. 14^2: *pl. 39a.*

EXSICCATI: Sull. Musci Amazon. Andini *116* (as *Z. subdenticulatus*).

NOTE: Malta (Latv. Bot. Darza Darbi 1: 122) remarks: "*Zygodon Reinwardtii* is a widespread and polymorphous species. The degree of serration of the leaf apex, the shape of the leaves and of the brood-bodies, the arrangement of the sex organs as well as the characteristics of the sporophyte vary a great deal." The rather broad, undulate leaves, the costa which shows in profile linear, smooth cells to within 50–100 μ of the apex will distinguish most specimens of this species from others that have teeth near the apex. These latter have short papillose cells on the upper half of the costa instead of merely on the upper 50–100 μ.

4. **Zygodon Liebmanni** Schimp. in C. Müll. Syn. **1**: 673. 1849.

Zygodon brevicollis Mitt. Jour. Linn. Soc. **12**: 234. 1869.
Zygodon affinis Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 186. 1872.
Zygodon mexicanus Jaeger, Ber. St. Gall. Nat. Ges. **1871–1872**: 390. 1873.
?*Zygodon oligodontus* Card. Rev. Bryol. **36**: 107. 1909.
Zygodon Jaffuelii Thér. Revista Chil. Hist. Nat. **25**: 300. 1921.

Plants in brownish tufts or cushions; stems about 1 cm. high, branched; brood-bodies small, short-clavate; leaves contorted-appressed when dry, spreading when moist, up to 1.5 mm. long (in the type), oblong-lanceolate to linear-lanceolate, shortly decurrent, carinate, acute, often broadly so, entire or occasionally having 1 or 2 teeth near the apex, the margins plane; costa ending in the apex, papillose on the back for nearly half its upper length; basal rectangular leaf-cells fewer than in related species; upper cells rounded-angular, incrassate, 8–13 μ in diameter; perichaetial leaves not differentiated; dioicous; seta up to 5 mm. long; capsules short-oblong to pyriform, 1–2 mm. long, 8-ribbed; operculum rostrate; peristome of 8 double teeth, short and truncate, papillose; inner peristome lacking or of 8 slender segments; spores 10–16 μ in diameter.

TYPE LOCALITY: On trunks of trees, Pico de Orizaba, Vera Cruz (*Liebmann*).
DISTRIBUTION: Mexico (*J. G. Smith 15; Pringle 10546*, as *Z. oligodontus*); Ecuador; Chile.
ILLUSTRATION: Latv. Bot. Darza Darbi 1: *f. 59*.
NOTE: Although Malta considers *Z. oligodontus* a synonym of *Z. Liebmanni*, it seems doubtfully so. The majority of the leaves of *Z. oligodontus* are dentate with several minute teeth near the apex and are larger, up to 2 mm. long as an average. The operculum of the type of *Z. oligodontus* is long-rostrate, half as long as the urn.

5. **Zygodon Ehrenbergi** C. Müll. Linnaea **18**: 672. 1844.

Tufts yellowish-green above, brown within; stems large for the genus, up to 2 cm. long, covered with numerous brown rhizoids, freely branched; leaves erect and loosely contorted when dry, erect-spreading to recurved when moist, rarely reaching 2 mm. in length, broadly lanceolate, shortly decurrent, narrower at the base than in the middle, acute, often ending in a single smooth, elongate cell, mostly entire, the margins more or less undulate; costa ending in or below the apex, finely papillose on the back of the upper $\frac{1}{3}$–$\frac{1}{2}$ of the length of the leaf; upper leaf-cells rounded-angular, papillose, 8–11 μ in diameter; basal cells rectangular, those near the costa longer than the marginal; perichaetial leaves not differentiated; dioicous; seta short; capsules 8-ribbed.

TYPE LOCALITY: Mexico (*Ehrenberg*).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATION: Latv. Bot. Darza Darbi 1: *f. 80c*.
NOTE: The leaves strongly resemble those of *Z. Reinwardti*, but differ as described. Perfect sporophytes are so infrequently collected in this genus that when more are found it may greatly modify taxonomic opinions about the species of this group.

6. **Zygodon campylophyllus** C. Müll. Syn. **1**: 680. 1849.

Zygodon domingensis Thér. Rev. Bryol. II. **14**: 14. 1944.

Plants loosely cespitose, bright green above; stems slender, 4–8 cm. long, flexuous, repeatedly branching, with abundant red-brown radicles below; leaves loosely contorted-appressed when dry, squarrose-reflexed when moist, 1.2 × 0.4 mm., lanceolate to linear-lanceolate, acute, decurrent, deeply canaliculate in the lower half, more or less dentate above, often very brittle and much broken, the margins plane above, more or less revolute below; costa papillose above on the back in most of the leaves, mostly ending below the apex; upper leaf-cells papillose, incrassate, irregularly angled, nearly isodiametric, 8–10 μ in diameter; basal cells larger, mostly rectangular and smooth; perichaetial leaves not differentiated; dioicous; seta up to 5 mm. long; capsules erect and symmetric, oblong-pyriform to oblong-cylindric, 8-ribbed when

dry; operculum long-rostrate; peristome double, the outer of the 8 easily split or broken teeth papillose; segments 8, slender, of a double row of cells; spores rough, 13–15 μ in diameter.

TYPE LOCALITY: Mexico (*Ehrenberg*).
DISTRIBUTION: On limestone, occasionally on wood; Guatemala (*Standley 81801, 81749, 81743, 84521b, 83089*, the last with very broad leaves); Santo Domingo (*Ekman 13777*, as *Z. domingensis* Thér.).
ILLUSTRATIONS: Latv. Bot. Darza Darbi 1: *f. 64, 104.*
NOTE: Malta states that the original type specimen is an extreme form, slender and depauperate with small leaves. According to him *Orcutt 6501* from Mexico and *Standley 83089* are more normal forms, difficult to distinguish from *Z. gracilis* Wilson of Europe. Thériot (Rev. Bryol. II. **14**: 14) refers *Ekman 3170* from Haiti to the Chilean *Z. pentastichus* (Mont.) C. Müll. I am unable to distinguish this specimen from *Z. campylophyllus*. Most of its leaves are coarsely serrate at the apex. Mitten and C. Müller both state that the leaves of *Z. pentastichus* are entire.

Section 2. Obtusifolii Malta, Acta Univ. Latv. **6**: 282. 1923. Leaves lingulate, rounded-obtuse, strongly papillose.

7. Zygodon obtusifolius Hook. Musci Exot. *pl. 159.* 1820.

Zygodon linguiformis C. Müll. Bot. Zeit. **16**: 163. 1858.
Zygodon spathulaefolius Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 187. 1872.
Codonoblepharum neglectum Jaeger, Ber. St. Gall. Nat. Ges. **1871–1872**: 396. 1873.
Zygodon erythrocarpus C. Müll. Linnaea **42**: 365. 1879.
Zygodon Araucariae C. Müll. Bull. Herb. Boiss. **6**: 95. 1898.

Plants dark green to brownish-green, in rather dense sods or cushions; stems in our specimens rather short, elsewhere up to 2 cm. long, branching, densely foliate; brood-bodies cylindric, often on the protonema; leaves appressed when dry, scarcely contorted, erect-spreading when moist, mostly less than 1 mm. long, lingulate, broadly obtuse and rounded at the apex, entire, plane or the margins slightly bent to the ventral side, densely papillose; costa strong, ending well below the apex, in cross section the cells not differentiated; upper leaf-cells incrassate, irregularly rounded, nearly isodiametric, the lumen 5–8 μ wide; perichaetial leaves often smaller, otherwise not differentiated; autoicous; seta up to 5 mm. long, yellow to brown; capsules obovoid to oblong, the neck longer or shorter, 8-ribbed when dry, brown to red-brown; calyptra usually papillose-roughened; operculum short-rostrate; peristome double, persistent, the outer of 8 broadly lanceolate, papillose teeth which reflex when dried, the inner of 8 or 16 segments from a low, striate membrane, strongly papillose in the upper part; spores smooth, 10–13 μ in diameter.

TYPE LOCALITY: Nepal.
DISTRIBUTION: On bark and wood; Mexico to Patagonia; Asia; Ceylon; New Zealand; Tasmania.
ILLUSTRATIONS: Latv. Bot. Darza Darbi 1: *f. 3a, b, 99, 100, 101.*
EXSICCATI: Ule, Bryoth. Brasil. *122, 130.*

Section 3. Bryoides Malta, Acta Univ. Latv. **6**: 281. 1923. Leaf-cells smooth; peristome double, well developed.

8. Zygodon pungens C. Müll. Bot. Zeit. **20**: 361. 1862.

Plants small; stems up to 4 mm. long, simple or branched; brood-bodies of a single row of cells, scarce; leaves erect-open when moist, less than 2 mm. long, linear-lanceolate, sharply acute, the margins plane and entire; costa strong, excurrent into a sharp point; upper leaf-cells smooth, less incrassate than in most species, rounded, little if any longer than broad, 10–16 μ in diameter; perichaetial leaves usually longer; autoicous; seta up to 3 mm. long; capsules short-oblong to pyriform, erect and symmetric, the urn 1–1.5 mm. long, 8-ribbed; operculum short-rostrate; peristome double, the outer of 8 double, lanceolate, papillose teeth, the inner of 8 slender, papillose segments; spores 13–16 μ in diameter.

TYPE LOCALITY: Venezuela (*Moritz*).
DISTRIBUTION: Guatemala and Costa Rica (*Standley 33611a*), south to Brazil.
ILLUSTRATION: Latv. Bot. Darza Darbi 1: *f. 90.*

INSUFFICIENTLY KNOWN SPECIES

ZYGODON ANGUSTATUS Schimp.; C. Müll. Syn. 1: 676. 1849. Müller described it, under species "non satis noti," as follows. Polygamous, densely cespitose, covered with a reddish tomentum even to the apex, densely foliate; leaves open, linear-acuminate, the margins plane or here and

there reflexed; seta short, pale; capsules long-necked; operculum long-rostrate; peristome imperfect. Mexico, ad montem Orizaba; *Liebmann*. Malta (Latv. Bot. Darza Darbi 1: 137) adds that there is no specimen of this in all the larger European herbaria, but that at Kew there is a specimen of *Z. polygamus* Schimp., collected by Liebmann on Orizaba and that it is not impossible that Schimper at another time named it *Z. angustatus*. Malta states that this specimen belongs with *Z. Reinwardti*.

ZYGODON CYLINDRICUS Schimp.; C. Müll. Syn. 1: 672. 1849. The following description is compounded of those of Müller and of Malta; the sporophyte was not attached in Malta's specimen. Mrs. Britton's notes state that there was no specimen in the Berlin herbarium. Plants loosely cespitose, freely branching; stems about 5 mm. long; brood-bodies clavate, of a single row of cells; leaves oblong-lanceolate to linear-lanceolate, acute, mostly entire, the upper somewhat recurved when moist, carinate; costa ending below the apex, papillose on the back above; upper leaf-cells irregularly hexagonal, only slightly incrassate, 8–10 μ in diameter, papillose; perichaetial leaves sometimes slightly toothed near the apex; dioicous; capsules long-exserted, erect, elongate-cylindric, long-necked; calyptra extending to the middle of the capsule; operculum conic-rostrate; outer peristome lacking, the inner of short, pale teeth. The type locality is Orizaba, Vera Cruz (*Liebmann*). The species is illustrated by Malta, Latv. Bot. Darza Darbi 1: *f. 84*.

Tribe 2. MACROMITRIEAE. Primary stems long, creeping, sending up numerous, erect to ascending, secondary stems, upon which the sporophytes are borne on short lateral branches, rarely being terminal. Leaf-cells incrassate, the upper shorter, often subcircular, the basal usually elongate. Capsules ovoid, oblong, or cylindric. Calyptra campanulate to mitrate, cucullate in *Drummondia* and *Pleurorthotrichum*.

Calyptra cucullate.
- Capsules immersed; perichaetial leaves hair-pointed; tropical. — 10. *Pleurorthotrichum.*
- Capsules long-exserted; perichaetial leaves acute; temperate. — 5. *Drummondia.*

Calyptra campanulate or mitrate.
- Basal leaf-cells short and rounded, somewhat larger than the upper.
  - Leaves bordered $\frac{1}{4}$–$\frac{4}{5}$ of the distance from the base by narrow linear cells. — 6. *Craspedophyllum.*
  - Leaves not bordered at the base.
    - Leaf-cells smooth to weakly mammillose. — 7. *Macrocoma.*
    - Leaf-cells with single, very large, sharp papillae. — 11. *Leiomitrium.*
- Basal leaf-cells much elongate, usually narrowly linear.
  - Calyptra mitrate and often plicate, deeply lobed, smooth or hairy; peristome lacking, single, or even double, the teeth when present truncate in most of our species. — 8. *Macromitrium.*
  - Calyptra campanulate, not plicate; peristome double, the teeth long-linear with a median line; segments shorter, pale, sometimes rudimentary. — 9. *Schlotheimia.*

5. DRUMMONDIA Hook.; Drummond, Musci Am. *62*. 1828; nomen conservandum propositum.

Leiotheca Brid. Bryol. Univ. 1: 728, in part. 1826.

Plants slender, in thin, dark green mats. Primary stems creeping, covered with brown rhizoids, bearing numerous, rather crowded, short, erect branches, simple or sparingly divided, densely foliate. Leaves appressed when dry, erect-spreading when moist, lanceolate, ovate-lanceolate, or elongate-oblong, acute to obtuse; costa strong, ending below the apex of the leaf; leaf-cells mostly rounded-polygonal, smooth. Dioicous or autoicous. Capsules exserted on a rather long, smooth seta, smooth, ovoidal, shrunken when dry and empty. Annulus lacking. Operculum rostrate. Calyptra cucullate, smooth. Peristome simple, the teeth very short, undivided, often truncate, smooth. Spores large, 80–100 μ in diameter, smooth.

Type species, *Drummondia prorepens* (Hedw.) O. Jennings.

1. Drummondia prorepens (Hedw.) O. Jennings, Mosses W. Pa. 116. 1913.

Gymnostomum prorepens Hedw. Sp. Musc. 35. 1801.
Drummondia clavellata Hook.; Drummond, Musci Am. *62*. 1828.

Plants in thin, dense mats, dark green to almost black below; primary stems long, reaching 10 cm. or more in length, sending up numerous short (2–10 mm. long), crowded, densely foliate branches; leaves closely appressed when dry, erect-spreading when moist, 1–2 mm. long, oblong-

lanceolate to ovate-lanceolate, acute to narrowly obtuse, concave, carinate, firm, the margins plane or widely inrolled, entire; costa strong, almost percurrent; upper leaf-cells small, the lumen 7–10 μ in diameter, rounded, incrassate; basal cells scarcely different except at the very insertion, where they are often larger and more translucent; in the perichaetial leaves basal cells elongate over a considerable area, becoming rectangular near the insertion; dioicous, the archegonia and antheridia in terminal buds; seta erect, 2–3 mm. long; capsules erect and symmetric, ovoid-globose, about 1–1.3 mm. long; calyptra large, conic, cucullate, without hairs; exothecial cells parenchymatous, thin-walled, irregular, oblong to hexagonal; stomata apparently lacking; operculum conic-rostrate, the beak long, oblique; mouth of the capsule bordered by several rows of small, thick-walled cells; peristome of 16 short teeth (about 60 μ long), truncate, smooth, persistent; inner peristome and annulus lacking; spores 60–90 μ in diameter, maturing in spring.

TYPE LOCALITY: Pennsylvania (*Muhlenberg*).

DISTRIBUTION: On the bark of trees; New England to Ontario, south to Georgia, Alabama, and Missouri; frequent in the northeastern United States.

ILLUSTRATIONS: Hedw. Sp. Musc. *pl. 3;* Sull. Ic. Musc. *pl. 33;* O. Jennings, Mosses W. Pa. *pl. 14.*

EXSICCATI: Drummond, Musci Am. *62;* Sull. Musci Allegh. *130;* Sull. & Lesq. Musci Bor. Am. *129;* ed. 2, *140;* Aust. Musci App. *152;* Small, Mosses So. U. S. *7.*

NOTE: The spores often appear multicellular as if cell division started before the spores are shed.

From trees, on Pelee Island in Lake Erie, 16 Je 1882, Macoun collected monoicous plants which Kindberg called *D. clavellata* var. *canadensis* (Macoun, Cat. Can. Pl. **6**: 81. 1892).

6. **CRASPEDOPHYLLUM** Grout, nom. nov.

Micromitrium Mitt. Jour. Linn. Soc. **12**: 218, as section. 1869; Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 190, as genus. 1872. Not *Micromitrium* Aust. 1870.

Plants growing mostly on bark and wood, occasionally on rocks. Leaf-cells uniformly rounded and nearly isodiametric to the base except a few at the insertion which are elongate and sometimes inflated and colored near the costa; cells of the marginal border long-linear, extending from half the distance from the base to near the apex in different species. Capsules mostly medium to large. Operculum acicular. Calyptra in many species short and covering only the upper third of the capsule, in others covering it entirely, smooth. Peristome rudimentary, lacking, single, or double, when present consisting of a low membrane or membranes only. Vaginulus often bearing rhizoids.

Type species, *Craspedophyllum fragile* (Mitt.) Grout.

NOTE: The species of this genus were formerly included in *Macromitrium* and supposedly characterized by their short calyptra; a minor character and one usually difficult of observation. The cellular leaf structure here used as the main basis of differentiation is found in all the original species. The generic name is derived from *κράσπεδον*, border.

Border extending nearly to the apex of the leaf. 1. *C. Husnoti.*
Border extending only half the length of the leaf or less.
  Upper and perichaetial leaves lanceolate at the base and ending in a linear upper portion of nearly equal length. 2. *C. fragile.*
  Leaves acute to apiculate or mucronate.
    Leaves mucronate.
      Leaves strongly rugose. 5. *C. rugosum.*
      Leaves not rugose.
        Mucro very short, the costa percurrent to excurrent; border about ⅓ the length of the leaf. 3. *C. mucronifolium.*
        Mucro prominent, consisting mainly of the excurrent costa; border up to ½ the length of the leaf. 4. *C. apiculatum.*
    Leaves acute to acuminate.
      Leaves undulate; capsules light brown. 7. *C. undosum.*
      Leaves slightly or not at all undulate. 6. *C. Wagnerianum.*

1. **Craspedophyllum Husnoti** (Schimp.) Grout, comb. nov.

Macromitrium Husnoti Schimp.; Besch. Ann. Sci. Nat. VI. **3**: 200. 1876.
Micromitrium Husnoti Grout, Bryologist **47**: 2. 1944.

Plants in rather dense, thin mats; secondary stems short, about 1 cm. long; leaves cirrhate-crispate when dry, erect-spreading when moist, about 2.5 × 0.4 mm., long-ligulate, abruptly rounded to a short apiculus, of nearly equal width throughout up to the apical, narrowing, deeply carinate, entire end; costa strong, widening perceptibly as it becomes excurrent

into the apiculus; marginal border of long, narrow cells extending nearly to the apex and noticeably wider near the base; upper leaf-cells small, about 8 μ in diameter, regularly arranged and nearly circular; lower cells little different until just at the insertion, where a few are somewhat elongate and incrassate, all smooth or slightly bulging; perichaetial leaves shorter, triangular, acute, their costa strong, excurrent into the apiculus where it widens preceptibly as it enters; seta 8–10 mm. long; capsules long-cylindric, smooth, thickest in the middle, the neck tapering, the urn including the neck up to 3 mm. long; calyptra smooth; operculum rostrate, about 1 mm. long; outer peristome present, thin, fragile, papillose; spores about 25 μ in diameter, finely papillose.

TYPE LOCALITY: Martinique.
DISTRIBUTION: On trees and shrubs; Cuba (*Maxon 4283; Bro. Clement 306*); Puerto Rico (*Britton, Metz & Chardon 6901*); Haiti (*Leonard 8372*); Venezuela (*Blakeslee* in the Farlow Herbarium).
EXSICCATI: Husnot, Pl. Antill. *145*.

2. **Craspedophyllum fragile** (Mitt.) Grout, comb. nov.

Macromitrium fragile Mitt. Jour. Linn. Soc. **12**: 218. 1869.
Micromitrium Schlumbergeri Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 191. 1872.
Micromitrium fragile Jaeger, Ber. St. Gall. Nat. Ges. **1872–1873**: 157. 1874.

Plants in wide, dense mats; secondary stems erect, 1–3 cm. long, more or less branching, relatively slender, very tomentose-radiculose; leaves appressed and contorted when dry, spreading and undulate when moist, very fragile and difficult to remove entire, the lower oblong-lanceolate, acute, entire or slightly toothed at the apex and base, up to 2 mm. long, the upper and perichaetial narrowly lanceolate from a broader, oblong base; costa subpercurrent; leaf-cells incrassate, the upper quadrate or irregular, more or less angular and usually faintly mammillose, the lower rounded, more incrassate and often highly mammillose, a few at the insertion elongate and colored, often somewhat inflated near the costa; bordering cells of the lower margins narrow, of narrowly linear cells, extending about half the length of the leaf, sometimes finely toothed near the base; "dioicous"; seta smooth, dark purple, up to 1 cm. long; capsules oblong-cylindric, dark purple, the urn up to 3.5 mm. long, plicate when dry; calyptra hairless, covering little more than the operculum; operculum short for the genus, acicular-rostrate; peristome rudimentary, of a low, hyaline, papillose membrane; spores finely papillose, 15–20 μ in diameter, maturing in winter.

TYPE LOCALITY: Near the mouth of the Amazon (*Spruce 110b, 110c,* in herb. N. Y. Bot. Gard.).
DISTRIBUTION: West Indies (*Orcutt 2375; E. G. Britton 559; Standley 33267*); Mexico; Central America (*Yuncker, Dawson & Youse 6403; Dodge & al. 6923*); South America.
PLATE 1. *f. 1–5*.
NOTE: *Macromitrium tomentosum* Hornsch. (in Mart. Fl. Bras. 1^2: 21. 1840) seems likely to prove a synonym, but the evidence at present is inconclusive.

3. **Craspedophyllum mucronifolium** (Hook. & Grev.) Grout, comb. nov.

Orthotrichum mucronifolium Hook. & Grev. Edinb. Jour. Sci. 1: 116. 1824.
Macromitrium obtusum Mitt. Jour. Linn. Soc. **12**: 201. 1869.
Micromitrium mucronifolium Grout, Bryologist **47**: 3. 1944.

Plants in wide, dense mats, dark green, almost black except at the tips of stems and branches; secondary stems short, 3–5 mm. long; leaves of the main stem oblong-lanceolate, acuminate, not mucronate, their costa excurrent; leaves of the secondary stems crowded, strongly twisted spirally around the stem when dry, widely spreading when moist, 1–1.5 mm. long, concave, lingulate, short-apiculate, more or less plicate longitudinally but not undulate nor transversely wrinkled above, the margins plane and entire; costa strong, extending into the mucro or ending just below it; upper leaf-cells rounded-hexagonal or irregular, incrassate, more or less mammillose or bulging, 7–9 μ in diameter, the marginal smaller; at the basal margins a few narrowly linear cells, in the main portion of the base only a few cells at the insertion noticeably elongate and colored; autoicous; seta 3–5 mm. long, smooth; capsules obovoid, whitish when old, the urn about 1.5 × 1 mm., smooth or slightly wrinkled at the base when dry and empty, but not contracted below the mouth; calyptra narrowly conical, covering the capsule to

the base, smooth; exothecial cells thin-walled, short-rectangular to oblong-hexagonal, with a few rows of small, rounded, dark-colored cells around the mouth; stomata in the narrow neck; peristome lacking or represented by an inconspicuous low membrane; spores maturing in summer.

TYPE LOCALITY: St. Vincent Island.
DISTRIBUTION: On the bark of shrubs and trees, especially on the upper side of horizontal branches; Florida; Mexico; Central America; the West Indies.
ILLUSTRATIONS: Edinb. Jour. Sci. 1: *pl. 4;* Grout, Moss Fl. N. Am. 2: *pl. 62A*. PLATE 1. *f. 6, 7.*
NOTE: All the available North American plants referred to the South American *Macromitrium tumidulum* Mitt. (Jour. Linn. Soc. 12: 201. 1869) are this species. *M. tumidulum* is a true *Macromitrium* and lacks the basal leaf-border of linear cells.
Schwaegr. Suppl. 22: *pl. 170* shows the apiculus too long and was probably drawn from a specimen of *C. apiculatum.*

4. **Craspedophyllum apiculatum** (Hook.) Grout, comb. nov.

Orthotrichum apiculatum Hook. Musci Exot. *pl. 45*. 1818.
Macromitrium apiculatum Brid. Bryol. Univ. 1: 311. 1826.
Macromitrium macrostomum Schwaegr. Suppl. 2²: 132. 1827.
Macromitrium brevipes C. Müll. Syn. 1: 728. 1849.
Micromitrium apiculatum Grout, Bryologist 47: 3. 1944.

Plants in wide, dense mats, dark green except at the young growing tips; primary stems creeping, bearing numerous branches, the upright secondary stems 2–3 cm. long; leaves crowded, strongly twisted spirally around the stem when dry, spreading when moist, 1–1.5 mm. long, concave, lingulate, apiculate by the excurrent costa (rarely a few leaves merely acute), more or less plicate longitudinally, but not or only slightly undulate or transversely wrinkled above, the margins plane and entire; costa strong, excurrent into a conspicuous mucro about 0.2 mm. long; upper leaf-cells irregular to rounded-hexagonal, incrassate, more or less mammillose, 7–10 μ in diameter, the marginal smaller; basal margin of narrow linear cells extending about half the length of the leaf; in the median portion of the base only a few cells at the insertion noticeably elongate and colored; autoicous; seta 3–5 mm. long, smooth; capsules oblong to obovoid, about 1.5 × 1 mm., smooth or slightly wrinkled at the base when dry and empty, not much contracted below the mouth; calyptra narrowly conical, covering the whole capsule, hairless; stomata in the narrow neck of the urn; operculum conic-rostrate, shorter than the urn; peristome lacking or represented by a low, inconspicuous membrane; spores maturing in summer.

TYPE LOCALITY: Near Jalapa, Vera Cruz (*Humboldt & Bonpland*).
DISTRIBUTION: On shrubs and trees; Mexico; Central and South America; abundant in the West Indies.
ILLUSTRATIONS: Hook. Musci Exot. *pl. 45;* Schwaegr. Suppl. 2²: *pl. 170*. PLATE 3. *f. 12–14.*
EXSICCATI: Wright, Cuban Mosses *50*.

5. **Craspedophyllum rugosum** Grout, comb. nov.

Micromitrium rugosum Grout, Bryologist 47: 3. 1944.

Plants in thin, close mats with the habit of *C. mucronifolium;* primary stems creeping, 2 cm. or more long, the secondary stems short, mostly less than 5 mm. long; leaves strongly contorted and incurved when dry, erect-spreading when moist, about 1.4 × 0.6 mm., oblong-lingulate, of nearly uniform width, strongly rugose above, entire, obtuse and mucronate above, the mucro mostly inflexed and so often making the leaf appear emarginate; costa nearly uniform in width, mostly excurrent into the short mucro; cells of the upper $\frac{2}{3}$–$\frac{3}{4}$ of the leaf subcircular, bulging to mammillose, 5–6 μ in diameter, in the basal $\frac{1}{3}$ somewhat larger, longer than broad; basal marginal cells linear, forming a narrow border about $\frac{1}{4}$ of the length of the leaf; seta about 5 mm. long, the slender neck of about the same length; calyptra hairless; operculum rostrate; peristome rudimentary, apparently a narrow membrane in the not fully ripened capsules.

TYPE LOCALITY: British West Indies (*John & Alice Northrop 342;* type in the Chicago Mus. Nat. Hist.)
DISTRIBUTION: Known only from the type locality.
NOTE: The leaves are as rugose as those of *Schlotheimia rugifolia* but much smaller, and the bordered leaf-base differentiates this species at once.

6. **Craspedophyllum Wagnerianum** (C. Müll.) Grout, comb. nov.

Macromitrium Wagnerianum C. Müll. Syn. **2**: 642. 1851.
Macromitrium chimborazense Spruce; Mitt. Jour. Linn. Soc. **12**: 218. 1869.
Micromitrium chimborazense Spruce; Jaeger, Ber. St. Gall. Nat. Ges. **1872–1873**: 157. 1874.
Macromitrium lamprocarpum C. Müll. Musci Polak. *116;* Ren. & Card. Bull. Soc. Bot. Belg. **31**[1]: 158. 1892.
Macromitrium Durandi Ren. & Card. Bull. Soc. Bot. Belg. **31**[1]: 159. 1892.
Micromitrium lamprocarpum Paris, Index Bryol. ed. 2, **3**: 241. 1905.
Micromitrium Wagnerianum Paris, Index Bryol. ed. 2, **3**: 242. 1905.

Plants densely cespitose, robust; secondary stems erect, branching, 1–5 cm. long, densely foliate; leaves cirrhate-crisped when dry, up to 2 mm. long, subundulate, oblong-lanceolate, rather sharply acute, somewhat plicate at the base, entire or often serrulate on the basal border, the margins rarely revolute; costa percurrent or vanishing slightly below the apex, rarely extending into a short apiculus; leaf-cells small, 5–7 μ in diameter, rounded and nearly isodiametric, nearly smooth to somewhat mammillose, a few at the insertion linear and colored and near the costa somewhat inflated, the border of narrowly linear cells extending about half the distance up the margin; perichaetial leaves broader, the border less distinct; seta purple, stout and erect, up to 1 cm. long; capsules large, the urn up to 3 mm. long by 1 mm. thick, usually finely plicate, oblong-cylindric, the neck short, paler with age; calyptra hairless, covering little more than the operculum; operculum shorter than the urn, long-rostrate, erect; peristome rudimentary, of a low membrane; spores variable in size, up to 25 μ in diameter, finely papillose.

TYPE LOCALITY: Jamaica (*Galipan*).
DISTRIBUTION: Mexico; Central and South America; the West Indies.
PLATE 2.
NOTE: An isotype of *Macromitrium Durandi* has been examined. Cardot states in notes after his description that the leaves of *M. Durandi* are very much like those of *M. lamprocarpum* in structure. A careful comparison of the two descriptions fails to show any considerable difference, except that the latter is more robust, particularly as to sporophyte and spores, and its smooth capsule becomes subplicate with age.

Occasionally the costa appears excurrent into an apiculus, but the leaves are much more acute than those of *C. apiculatum*. Apparently dioicous, since antheridia were not found.

7. **Craspedophyllum undosum** (Card.) Grout, comb. nov.

Macromitrium undosum Card. Rev. Bryol. **36**: 108. 1909.
Macromitrium densifolium Card. Rev. Bryol. **36**: 108. 1909. Not *M. densifolium* Thér. 1908.
Macromitrium pycnophyllum Card. Rev. Bryol. **37**: 13. 1910.
Micromitrium undosum Grout, Bryologist **47**: 4. 1944.

Plants in wide, rather thin mats; secondary stems short, only a few mm. long, radiculose, freely branching, densely foliate; leaves strongly cirrhate-crisped when dry, up to 2.5 mm. long, oblong-lanceolate, strongly undulate-rugose, acute to shortly acuminate, the margins entire, not revolute, rarely faintly toothed at the apex; costa usually ending just below the apex; leaf-cells incrassate, the upper 5–7 μ in their longest dimension, subcircular, sometimes slightly elongate laterally, somewhat mammillose, the median basal somewhat larger, slightly elongate, more strongly mammillose, the basal margin of linear cells extending at least half-way to the costa at the base, narrowed above but extending half-way to the apex, a few basal cells next to the costa inflated; perichaetial leaves shorter; sporophyte brown; seta up to 5 mm. long; capsules oblong-cylindric, finely plicate, the urn having a slender neck up to 2.5 mm. long; operculum slenderly rostrate; peristome rudimentary, membranous; spores finely papillose, 20–25 μ in diameter, maturing in autumn.

TYPE LOCALITY: Near Guadalajara, Jalisco, on rocks in a barranca (*Pringle 10560;* isotype examined).
DISTRIBUTION: Mexico; Guatemala (*Standley 80953, 80370*); Costa Rica (*Gutiérrez 210, 211*).
PLATE 3. *f. 15–17.*
NOTE: *C. undosum* differs from *C. Wagnerianum* chiefly in the much more strongly undulate-rugose leaves and the more numerous, slightly elongate basal cells; also the leaf-cells are more strongly mammillose. The capsule is usually lighter-colored.

No authentic material of *Macromitrium semimarginatum* C. Müll. and *M. orthotrichaceum* C. Müll. (Bull. Herb. Boiss. **5**: 197. 1897) has been available. From the descriptions they seem to belong to *Craspedophyllum*. It is more than probable that both will prove to be synonyms of species described earlier.

7. **MACROCOMA** (Hornsch.) Grout, Bryologist **47**: 4. 1944.

Macrocoma Hornsch.; C. Müll. Syn. 1: 720, as section. 1849.

Plants very slender, filiform, in rather thin, tangled mats. Stems rather irregularly branching. Leaves appressed when dry, scarcely contorted, erect-spreading when moist; leaf-cells subcircular to oval even to the base (except a few at the insertion slightly elongate), incrassate, somewhat bulging to submammillose. Seta smooth. Capsules more or less plicate, narrowed above. Calyptra mitrate, plicate and fimbriate at the base. Peristome a more or less fugacious membrane or in some species of 16 short teeth.

Type species, *Macrocoma filiforme* (Hook. & Grev.) Grout.

Calyptra hairy;* peristome a mere membrane. 1. *M. hymenostomum.*
Calyptra smooth to slightly hairy; peristome of 16 short teeth. 2. *M. filiforme.*

1. **Macrocoma hymenostomum** (Mont.) Grout, comb. nov.

Macromitrium hymenostomum Mont. Ann. Sci. Nat. III. **4**: 120. 1845.
Macromitrium Dregei sensu Sull. Musci U. S. 35. 1856. Not *M. Dregei* Hornsch. 1841.
Macromitrium Sullivantii C. Müll. Bot. Zeit. **20**: 361. 1862.
Macromitrium paraphysatum Mitt. Jour. Linn. Soc. **12**: 198. 1869.
Macromitrium mexicanum Mitt. Jour. Linn. Soc. **12**: 198. 1869.
Macromitrium Leiboldtii Hampe, Bot. Zeit. **28**: 50. 1870.
Macromitrium Ghiesbreghtii Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 188. 1872.
Macromitrium Fitzgeraldi Lesq. & James, Man. 178. 1884.
Macromitrium Harioti Besch. Bull. Soc. Bot. Fr. **32**: LXI. 1885.
Macromitrium bolivianum C. Müll. Nuov. Giorn. Bot. Ital. II. **4**: 126. 1897.
Macrocoma Sullivantii Grout, Bryologist **47**: 5. 1944.

Plants in rather thin, dense, dark green mats, reddish-brown below; primary stems creeping, 5–7 cm. long, sending up numerous slender, suberect, densely foliate, subjulaceous secondary stems 1–2 cm. long; branch leaves closely imbricate when dry, not contorted nor crisped, erect-spreading when moist, about 1 mm. long, lanceolate to narrowly triangular-lanceolate, narrowed to the insertion, gradually acuminate, acute to narrowly obtuse at the apex, carinate, somewhat excavate at the base as in *Ulota*, the margins plane or slightly revolute below, nearly or quite entire; costa strong, extending nearly to the apex; upper leaf-cells about 7 μ in diameter, rounded, incrassate, slightly bulging to mammillose, slightly smaller on the margins; lower cells near the base a little larger, more translucent, often strongly mammillose; perichaetial leaves longer, more slenderly acute, all the basal cells less elongate, oblong-rhomboidal; monoicous, the antheridial buds axillary or terminal; perigonial leaves ovate, erose-serrulate above; seta erect, smooth, 5–8 mm. long; capsules oblong-cylindric, about 3 mm. long, somewhat plicate at the mouth and base when dry and empty; calyptra hairy, covering the whole capsule; operculum conic-subulate; peristome consisting only of a narrow inconspicuous membrane representing the inner peristome.

TYPE LOCALITY: Chile.
DISTRIBUTION: Southern United States; Mexico; Central and South America.
ILLUSTRATION: Sull. Ic. Musc. *pl. 37.*
EXSICCATI: Sull. & Lesq. Musci Bor. Am. *128;* ed. 2, *193.*

2. **Macrocoma filiforme** (Hook. & Grev.) Grout, Bryologist **47**: 5. 1944.

Orthotrichum filiforme Hook. & Grev. Edinb. Jour. Sci. **1**: 116. 1824.
Macromitrium filiforme Schwaegr. Suppl. 2^2: 64. 1826.
Macromitrium brasiliense Mitt. Jour. Linn. Soc. **12**: 197. 1869.
? *Macromitrium Braunioides* Card. Rev. Bryol. **36**: 108. 1909.
Macromitrium Pringlei Card. Rev. Bryol. **36**: 108. 1909.

Sterile forms scarcely distinguishable from *M. hymenostomum;* leaves a little less concave at the base next the costa; capsules more strongly plicate; calyptra with few hairs or even none; outer peristome of 16 teeth, short but firm and papillose; spores papillose, up to 40 μ in diameter.

TYPE LOCALITY: Brazil.
DISTRIBUTION: Mexico; Central and South America.

*** It is difficult if not impossible to differentiate these two species when they are sterile.**

ILLUSTRATIONS: Edinb. Jour. Sci. 1: *pl. 4*: Schwaegr. Suppl. 2^2: *pl. 171.*

NOTE: Gardener's specimen from Brazil cited by Mitten under *M. brasiliense* is in herb. N. Y. Bot. Gard.; it has smooth capsules as Mitten states. Schwaegrichen (Suppl. 2^2: 64) states that the capsules are striate, and so figures them. Other Brazilian plants at the N. Y. Bot. Gard. have both smooth and plicate capsules on the same mat of plants. There is also considerable variation in the hairiness of the calyptra.

8. **MACROMITRIUM** Brid. Musc. Recent. Suppl. 4: 132. 1819.

Plants slender to robust, mostly in close mats or cushions on bark and wood, dark green to reddish-green, or almost black in the older parts, usually bright green in the youngest parts. Primary stems creeping, up to 10 cm. or more long, sending up numerous shorter secondary stems which are more or less branched and densely foliate. Leaves mostly appressed when dry, contorted to strongly crisped, erect to squarrose-spreading when moist, lanceolate, oblong-lanceolate, lingulate, or nearly linear, obtuse, acute, hair-pointed, or mucronate, more or less plicate below, usually plane to concave above, sometimes carinate, often with large tubercle-like papillae on the lower, linear leaf-cells, the usually short upper cells smooth to strongly mammillose or papillose above, all strongly incrassate. Perichaetial leaves various, the leaf-cells usually more elongate. Monoicous to dioicous; archegonia borne in lateral buds on secondary stems or branches and appearing pleurocarpous. Seta with few exceptions long-exserted, smooth or papillose-roughened. Capsules subglobose to oblong-cylindric. Operculum mostly long-rostrate. Stomata superficial. Calyptra mitrate, plicate, smooth or hairy, usually covering most of the capsule. Annulus apparently lacking in most species. Peristome lacking to double with truncate or lanceolate, papillose teeth and a membranous inner peristome that may be divided into segments or merely lacerate. Spores mostly large and papillose.

Type species, *Macromitrium aciculare* Brid.

NOTE: The species lacking basal linear leaf-cells have been segregated into *Macrocoma*. Those having only a few linear cells at the basal border have been placed in *Craspedophyllum*. Owing to the impossibility of obtaining type material from abroad, some of the conclusions on synonymy may be mistaken, but all available material has been carefully examined and the evidence carefully weighed. Because sporophytes are so often lacking or in poor condition, leaf structure has been used as much as possible in describing and delimiting species.

Leaves slenderly acute to long-acuminate (except in *M. punctatum*).
  Leaves long-filiform-acuminate, with a non-hyaline hair-point composed mostly of the excurrent costa. — KEY 1.
  Leaves sharply acute to acuminate. — KEY 2.
Leaves broadly acute to rounded-obtuse, often mucronate. — KEY 3.

KEY 1

Upper leaf-cells nearly isodiametric (except at the apex), not more than twice as long as broad.
  Leaves 7–10 mm. long; costa long-excurrent; hair-point up to ⅓ the length of the leaf. — 12. *M. fulgescens.*
  Leaves 5–6 mm. long; hair-point of the excurrent costa ¼ the length of the leaf or less (*M. trinitense* may be sought here). — 8. *M. palmense.*
Upper leaf-cells three times as long as broad or more.
  Leaves sharply ciliate-dentate above. — 15. *M. Standleyi.*
  Leaves serrulate to entire above.
    Seta papillose with rather low, scattered papillae.
      Hair-point often nearly entire; marginal leaf-cells little differentiated. — 11. *M. Williamsi.*
      Hair-point serrulate; marginal cells of the upper part of the leaf usually noticeably longer than the median. — 10. *M. scoparium.*
    Seta smooth.
      Leaf-cells narrowly linear throughout. — 33. *M. dubium.*
      Upper leaf-cells oblong or otherwise markedly different from the linear basal cells.
        Longest hair-point ¼ the length of the leaf or less. — 16. *M. subcirrhosum.*
        Longest hair-point ⅓ the length of the leaf or more.
          Basal leaf-cells strongly tuberculate. — 9. *M. trinitense.*
          Basal leaf-cells smooth or with only a few low papillae.
            Hair-point consisting almost entirely of the excurrent costa and entire except occasionally at the apex where it may be toothed. — 13. *M. flavopilosum.*
            Hair-point for the most part bordered by the narrow upper lamina and serrulate throughout. — 14. *M. fusco-aureum.*

KEY 2

Upper leaf-cells elongate, three times as long as broad or more.
  Many leaves with truncate lamina but excurrent costa. — 17. *M. perichaetiale.*
  Leaves rather abruptly narrowed to an acute apex. — 34. *M. Dussii.*
Upper leaf-cells isodiametric or not more than twice as long as broad, except at the extreme apex.
Seta strongly papillose.
  Calyptra hairy; leaves undulate. — 5. *M. homalacron.*
  Calyptra smooth.
    Outer peristome a truncate cone of 16 more or less united teeth. — 4. *M. longifolium.*
    Peristome perfect, the teeth linear-lanceolate. — 6. *M. Greenmani.*
Seta smooth.
  Many leaves with rather short, coarse, hyaline teeth on the basal margin.
    Upper leaf-cells highly mammillose. — 20. *M. serrulatum.*
    Upper leaf-cells smooth or faintly mammillose.
      Leaves sharply acute, finely serrulate. — 21. *M. guatemalense.*
      Leaves broadly acute, strongly dentate-serrate. — 22. *M. punctatum.*
  Leaves without coarse basal marginal teeth.
    Basal leaf-cells strongly tuberculate.
      Inner perichaetial leaves slenderly long-acuminate; seta rarely more than 1 cm. long.
        Leaves acute; costa percurrent to slightly excurrent. — 1. *M. cirrosum.*
        Leaves slenderly acuminate; costa plainly excurrent.
          Leaves nearly or quite entire — 3. *M. Harrisi.*
          Leaves strongly serrate above. — 18. *M. costaricense.*
      Inner perichetial leaves shorter than the stem leaves, abruptly short-acuminate; seta up to 18 mm. long.
        Dioicous; leaves rarely undulate; upper leaf-cells typically in rows. — 1. *M. cirrosum* var. *stenophyllum.*
        Monoicous; leaves more or less undulate; upper leaf-cells distinctly not in rows. — 2. *M. Tonduzii.*
    Basal leaf-cells smooth to slightly papillose.
      Upper leaf-cells nearly or quite smooth. — 7. *M. stratosum.*
      Upper leaf-cells highly mammillose.
        Costa percurrent or nearly so; seta 1 cm. long; capsules 2 mm. long; calyptra smooth. — 19. *M. mammillosum.*
        Costa mostly short-excurrent; seta 4–5 mm. long; capsules 1.5 mm. long; calyptra hairy. — 23. *M. pentastichum.*

KEY 3

Basal leaf-cells short, three times as long as broad or less.
  Leaf-cells highly mammillose to tuberculate. — 31. *M. altituberculosum.*
  Leaf-cells smooth or nearly so. — 32. *M. Swainsoni.*
Basal leaf-cells narrowly long-linear.
  Basal leaf-cells smooth or nearly so.
    Upper leaf-cells conspicuously mammillose. — 24. *M. Richardi.*
    Upper leaf-cells smooth to somewhat bulging.
      Leaves lanceolate, broadly acute; upper leaf-cells isodiametric, the lumen 4–5 μ in diameter. — 28. *M. clavatum.*
      Leaves oblong, abruptly mucronate, the apex mostly recurved; upper leaf-cells oblong to oval, the lumen up to 12 μ long. — 29. *M. pellucidum.*
  Basal leaf-cells papillose to tuberculate.
    Basal leaf-cells slightly papillose; thick mucro of the leaf usually broken off. — 27. *M. fragilicuspis.*
    Basal leaf-cells tuberculate.
      Leaves abruptly mucronate by the excurrent costa. — 30. *M. parvirete.*
      Leaves broadly acute; costa merely percurrent.
        Leaf-cells merely bulging, 5–7 μ in diameter. — 25. *M. Podocarpi.*
        Leaf-cells strongly mammillose above; leaf-cells up to 10 μ in diameter. — 26. *M. portoricense.*

1. **Macromitrium cirrosum** (Hedw.) Brid.

Bryol. Univ. 1: 316. 1826.

Anictangium cirrosum Hedw. Sp. Musc. 42. 1801.
Hypnum cirrhatum Brid. Musc. Recent. **2**[2]: 185. 1801.
Schlotheimia cirrosa Schwaegr. Suppl. **3**[1]: pl. 201. 1827.
Macromitrium Schwaneckeanum Hampe, Linnaea **25**: 360. 1853.
Macromitrium praelongum Mitt. Jour. Linn. Soc. **12**: 207. 1869.
Macromitrium microtheca Mitt. Jour. Linn. Soc. **12**: 208. 1869.
Macromitrium barbense Ren. & Card. Bull. Soc. Bot. Belg. **31**[1]: 157. 1892.
Macromitrium erecto-patulum C. Müll. Nuov. Giorn. Bot. Ital. II. **4**: 124. 1897.
Macromitrium cubensi-cirrhosum C. Müll. Hedwigia **37**: 236. 1898.
? *Macromitrium pseudocirrhosum* C. Müll. Hedwigia **37**: 237. 1898.

Plants in dense mats, brown at the base, bright green at the growing tips; secondary stems up to 2 cm. or more in length, simple or sparingly branched, densely foliate; leaves of the secondary stems crispate from an appressed base when dry, erect-spreading when moist, up to 4 mm. long, linear-lanceolate, narrowly acute, more or less serrulate above, carinate, somewhat plicate, the lower margins more or less reflexed; costa subpercurrent to occasionally briefly excurrent; upper leaf-cells very incrassate, rounded, mostly somewhat longer than broad, including the walls 8–13 μ long in the longest dimension, elongate at the apex, often irregular, sometimes apparently in rows, smooth to somewhat bulging or mammillose, gradually elongating below and in the basal portion narrowly long-linear with walls as thick as the lumen is wide, bearing very large, coarse papillae or tubercles; inner perichaetial leaves typically as long as the others and rather more slender, very gradually narrowed; seta rarely more than 1 cm. long, smooth; capsules obovoid, smooth, not much narrowed at the mouth, the urn 1.2–2 mm. long; calyptra without hairs; annulus lacking; operculum hemispheric, rostrate, nearly as long as the urn; peristome-teeth more or less united, obtuse, up to 0.4 mm. long, strongly papillose with bulging divisions; segments of the inner peristome longer than the teeth, from a wide basal membrane, narrow and somewhat irregular in outline; spores smooth, quite variable in size, up to 22 μ in diameter, maturing from autumn to winter.

TYPE LOCALITY: Jamaica (a portion of the type has been examined).
DISTRIBUTION: Mainly on bark and wood, especially on twigs; common in the West Indies; Central and South America.
ILLUSTRATIONS: Hedw. Sp. Musc. *pl. 5;* Schwaegr. Suppl. 3[1]: *pl. 201.*
EXSICCATI: Wright, Cuban Mosses *51*, in part.
NOTE: Variable and often puzzling. Several authors have founded species on its variations. The shape and arrangement of its leaf-cells vary considerably even on the same plant, the cells in the older leaves apparently showing the arrangement in rows less plainly. There are so many intergradations between this and *M. stenophyllum* Mitt. that it seems best to regard the latter as merely a variety of *M. cirrosum;* yet the extreme forms are markedly different. *M. praelongum* is an example of intergradation. Guilding's plants from St. Vincent Island, cited by Mitten as type, have the smooth capsule and short seta of this species, but the short perichaetial leaves of *M. stenophyllum.* In Wright's Cuban Mosses *51*, type of *M. cubensi-cirrhosum*, there are plants that match *M. cirrosum* as here defined and others that answer to the description of *M. stenophyllum. M. barbense* is a form of *M. cirrosum* with nearly entire leaves and less strongly tuberculate basal cells. *Schlotheimia oblonga* Tayl. (Lond. Jour. Bot. **5**: 46. 1846) is not a synonym of *M. longifolium* as stated by Paris (Index Bryol. ed. 2. **3**: 208) but a species closely related to *M. cirrosum*, differing chiefly in the undulate leaves and strongly ribbed capsules (type examined). *M. pseudocirrhosum* is, from its description, almost certainly a synonym; no authentic specimens have been available.

Macromitrium cirrosum var. **stenophyllum** (Mitt.) Grout, Bryologist **47**: 9. 1944. *Macromitrium stenophyllum* Mitt. Jour. Linn. Soc. **12**: 215. 1869. In typical form distinguished from *M. cirrosum* by the more robust habit, more excurrent costa, and by the upper leaf-cells which are more plainly in rows; perichaetial leaves shorter than the stem leaves, abruptly short-acuminate, strongly serrate, their cells all elongate; seta up to 18 mm. long; capsules often somewhat plicate. TYPE LOCALITY: Jamaica (*Wilson 607* in herb. Hooker). DISTRIBUTION: With the species. EXSICCATI: Broth. Musci Jamaic. *60* (as *M. cirrosum*). NOTE: *E. G. Britton 58, 112* from Jamaica are this variety.

Macromitrium cirrosum var. **jamaicense** (Mitt.) Grout, Bryologist **47**: 9. 1944. *Macromitrium jamaicense* Mitt. Jour. Linn. Soc. **12**: 209. 1869. *Macromitrium altipes* C. Müll. Bull. Herb. Boiss. **5**: 559. 1897. *Macromitrium Werckleanum* Thér. Rec. Soc. Havr. Étud. Div. **1921**: 307. 1921. Perichaetial leaves of var. *stenophyllum;* upper leaf-cells not in rows, irregular, 5–7 μ in diameter; basal marginal cells conspicuously narrower than the median; other characters mainly those of *M. cirrosum.* TYPE LOCALITY: Jamaica (*Wilson 832* in herb. N. Y. Bot. Gard.). DISTRIBUTION: On trees and shrubs; common in the West Indies; Puerto Rico (*Britton & Hess 2298*); Cuba (*Hioram 2263; Bro. Leonard 325*).

2. **Macromitrium Tonduzii** Ren. & Card. Bull. Soc. Bot. Belg. 31[1]: 155. 1892.

Plants in wide, reddish mats; primary stems long, prostrate; secondary stems erect, somewhat branching, 2–5 cm. long, not tomentose; leaves crisped when dry, erect-open when moist, about 5 × 0.5 mm., long-lanceolate from a relatively narrow base, subulate-acuminate, carinate, plicate below, more or less undulate above, serrate in the upper half; costa mostly excurrent into a sharply serrate point; upper leaf-cells oval to short-oblong, up to 10 μ in their longest dimension, very incrassate, more elongate on the margins, smooth, gradually elongating to the narrowly linear, strongly incrassate basal cells which are more or less papillose and narrower on the margins; perichaetial leaves shorter, abruptly acuminate, coarsely and irregularly serrate, their upper cells more elongate; monoicous; seta smooth, 6–16 mm. long; capsules

erect, symmetric, subglobose, the short neck often plicate when dry and empty, narrower at the mouth, brown, sometimes slightly ribbed, the urn about 1.5 mm. long; calyptra without hairs; stomata numerous, in the neck of the capsule; operculum rostrate, about as long as the urn; peristome double, the outer a brown cone of truncate, papillose teeth, the inner a low basal membrane with more or less linear, papillose segments often as long as the teeth; spores up to 25 μ in diameter, maturing in March.

TYPE LOCALITY: Forests of Rancho Flores, Costa Rica (*Pittier 5545*).
DISTRIBUTION: Costa Rica (*Standley 32919, 33220, 50550*).
NOTE: This species differs from *M. cirrosum* var. *stenophyllum* in that its upper leaf-cells are not in rows and the basal cells are papillose but scarcely tuberculate.

3. **Macromitrium Harrisi** Paris, Index Bryol. Suppl. 238. 1900.

Macromitrium peraristatum C. Müll. Bull. Herb. Boiss. **5**: 560. 1897. Not *M. peraristatum* Broth. 1893.

Very closely related to *M. cirrosum;* leaves mostly entire; costa excurrent into a short, nearly smooth arista; upper leaf-cells in well-defined rows, mammillose in the upper median region; perichaetial leaves as in *M. cirrosum* var. *stenophyllum;* seta usually less than 1 cm. long; capsules plainly but not strongly ribbed; inner peristome apparently not well developed, consisting of a membrane attached to the teeth.

TYPE LOCALITY: On rocks, Jamaica (*Harris 10033*).
DISTRIBUTION: Mainly on twigs, bark, and wood; Jamaica (*Nichols 117, Maxon 753, 1296, 9753*); Cuba (*Acuña 367, León 11210*).
NOTE: The characters by which this species differs from *M. cirrosum* and its varieties are eminently variable.

4. **Macromitrium longifolium** (Hook.) Brid. Bryol. Univ. **1**: 309. 1826.

Orthotrichum longifolium Hook. Musci Exot. *pl. 44.* 1818.
Macromitrium scabrisetum Wilson: Hook. f. Trans. Linn. Soc., **20**: 165. 1847.
Macromitrium Mülleri Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 185. 1872. Not *M. Mülleri* Hampe, 1860.
Macromitrium flexuosum Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 189. 1872. Not *M. flexuosum* Mitt. 1869.
Macromitrium Schimperi Jaeger, Ber. St. Gall. Nat. Ges. **1872-1873**: 129. 1874.
Macromitrium denudatum Jaeger, Ber. St. Gall. Nat. Ges. **1872-1873**: 146. 1874.
Macromitrium longifolium var. *viridissimum* Ren. & Card. Bull. Soc. Bot. Belg. **31**[1]: 156. 1892.
Macromitrium scleropelma Ren. & Card. Bull. Soc. Bot. Belg. **31**[1]: 157. 1892.

Plants, leaves, and perichaetial leaves so closely resembling those of *M. cirrosum* var. *stenophyllum* that it is all but impossible to distinguish sterile plants; seta very rough with rather coarse papillae; capsules strongly ribbed; peristome scarcely different.

TYPE LOCALITY: On the slopes of Mount Avilla, near Caracas, alt. 5700 ft.
DISTRIBUTION: On trees and shrubs; West Indies; Mexico; Central and South America.
ILLUSTRATIONS: Hook. Musci Exot. *pl. 44.*
NOTE: Hooker's description does not mention the rough seta nor the inner peristome and states that the leaves are entire. Mitten describes the seta as rough. He probably had access to Hooker's type. From the examination of numerous specimens it is evident that serration of the leaves or the lack of it is variable even on the same plant, and what seems to be an isotype in the Mitten herbarium has the leaves finely serrulate at the apex.

5. **Macromitrium homalacron** C. Müll. Bull. Herb. Boiss. **5**: 197. 1897.

Macromitrium haitense Thér. Rev. Bryol. II. **14**: 15. 1944.

Differing from *M. longifolium* in having most leaves undulate and the calyptra hairy; outer peristome-teeth less truncate, less adherent.

TYPE LOCALITY: Coban, Guatemala, alt. 4300 ft. ("*Türckheim* in herb. Brotherus").
DISTRIBUTION: Guatemala; Costa Rica; Jamaica; Haiti.
NOTE: Data were taken from *Türckheim 13* from Guatemala in herb. N. Y. Bot. Gard., determined by Müller and labeled cotype by Brotherus. Contrary to the original description the seta is rough and the capsules ribbed. An isotype of *M. haitense* sent me by M. Thériot differs from the type material of *M. homalacron* in little but the more elongate apical cells of many of the leaves.

6. **Macromitrium Greenmani** Grout, Bryologist **47**: 11. 1944.

Differing from *M. longifolium* and *M. homalacron* in having the calyptra smooth and the outer peristome of narrowly lanceolate teeth, not truncate, well separated, the divisions marked with fine radiating lines; inner peristome a wide basal membrane bearing linear segments nearly or quite as long as the teeth, papillose.

TYPE LOCALITY: Costa Rica (*Greenman 5574* in herb. Bartram; isotype in herb. Grout; also in herb. Mo. Bot. Gard.).
DISTRIBUTION: Known only from the type locality.
NOTE: It seems impossible to identify with certainty specimens lacking calyptra and peristome.

7. **Macromitrium stratosum** Mitt. Jour. Linn. Soc. **12**: 199. 1869.

Macromitrium cacuminicolum C. Müll. Bull. Herb. Boiss. **5**: 559. 1897.
Macromitrium Acunae Thér. Mem. Soc. Cub. Hist. Nat. **14**: 353. 1940.

Plants densely cespitose; primary stems densely branching; secondary stems short, 1–2 cm. long, rarely longer, more or less branched, densely foliate; leaves appressed and incurved-contorted when dry, erect-open when moist, about 2 mm. long, lanceolate, narrowly acute to slenderly acuminate, carinate, somewhat plicate, the margins plane and entire; costa percurrent to shortly excurrent; upper leaf-cells subcircular, the lumen about 5 μ in diameter, or short-oblong, elongate near the costa and at the extreme apex, smallest and often transversely elongate at the upper margins, all very incrassate, gradually elongate toward the narrowly linear basal cells which have no tubercles and thin transverse walls; perichaetial leaves broader, abruptly narrowed to a hair-point consisting of the excurrent costa; monoicous; seta up to 16 mm. long; capsules obovoid, the neck short, the urn including the neck about 1.6 mm. long, somewhat plicate and narrowed at the mouth when dry; operculum long-rostrate, shorter than the urn; peristome single, up to 0.18 mm. long, strongly papillose; spores finely papillose, up to 45 μ in diameter.

TYPE LOCALITY: Jamaica (*Maxwell;* type from herb. Mitten at the N. Y. Bot. Gard. examined).
DISTRIBUTION: On twigs and branches of trees; Jamaica; Cuba (*Maxon 9984; Orcutt 2863; Harris 11056, 11129*); Costa Rica (*Alfers 77; Valerio 70*); Guatemala (*Standley 92406*).
NOTE: An isotype of *M. cacuminicolum* (Jamaica, *Harris 10960*) has been examined.

8. **Macromitrium palmense** R. S. Williams; Britt. & Williams, Torreya **14**: 25. 1914.

Plants in deep tufts, the primary stems bare, creeping; secondary stems erect, branching, without radicles, 5–6 cm. high; leaves densely imbricate, spreading-crispate above, 5–6 mm. long, linear-lanceolate, carinate, serrulate about half the distance from the apex, smooth throughout or with a few low papillae on the upper surface toward the base; costa long-excurrent, moderately toothed; upper median leaf-cells in more or less apparent rows, 6 μ wide and from nearly the same length to twice as long; marginal cells usually more elongate; cells near the base narrowly long-linear; all cells incrassate; perichaetial leaves shorter, more abruptly narrowed to the denticulate, excurrent costa, all the cells narrowly linear except a few near the costa in the upper portion; pseudautoicous; seta smooth, 1.5–2.5 cm. long; capsules smooth or nearly so, globose-pyriform, the urn about 1.5 mm. long; stomata superficial in several rows near the base; calyptra smooth or slightly rough at the apex; operculum not seen; peristome double, the outer of reddish-brown, densely papillose teeth divided scarcely half their length; inner peristome of about the same length, paler, more or less irregularly divided; spores up to 35 μ in diameter, slightly rough.

TYPE LOCALITY: La Palma, Costa Rica, on tree trunks, alt. 1450–1550 m. (*Maxon 480;* type in herb. N. Y. Bot. Gard.)
DISTRIBUTION: Costa Rica (*Brenes 20587; Valerio 2*).

9. **Macromitrium trinitense** R. S. Williams, Bryologist **24**: 65. 1922.

Secondary stems curved, 1–3 cm. high, brown below, yellow-green above; leaves contorted to subcrisped when dry, 5–7 mm. long, narrowly lanceolate, serrulate half their length or more,

the slender, flexuous points often twisted when dry, the margins plane above and often undulate; costa rarely excurrent, the very narrow lamina usually extending to the apex; leaf-cells elongate, mostly unipapillate on both sides from near the apex to the base, the median cells variable with prominent papillae and broad lumen or in older leaves with more indistinct papillae and narrower lumen; cell walls unequally thickened, the lumen more or less flexuous; outer perichaetial leaves similar, the inner 2 or 3 ⅓–½ as long, more or less oblong, abruptly narrowed and irregularly serrate above to a short, nearly entire point; evidently dioicous; seta smooth, 6–8 mm. long; capsules smooth, globose-pyriform, when dry tapering to a somewhat ribbed neck, the urn about 1 mm. long; calyptra not hairy but somewhat scabrous above, deeply laciniate; operculum slenderly rostrate, about 1 mm. long; peristomes seen imperfect, evidently double; spores slightly roughened, 22–25 μ in diameter.

TYPE LOCALITY: On tree trunks, El Valle to San Juan, Trinidad (*J. R. Johnson 163*).
DISTRIBUTION: Trinidad (*Crüger* in herb. Mitten at the N. Y. Bot. Gard.); near Kaietur Falls, British Guiana (*Miss S. F. Noel*).
ILLUSTRATION: Bryologist **24**: *pl. 4*.
NOTE: Distinguished from all other species with hair-pointed leaves and elongate upper cells by the scarcely excurrent costa and strongly papillose upper cells.

10. **Macromitrium scoparium** Mitt. Jour. Linn. Soc. **12**: 206. 1869.

Macromitrium trichophyllum Mitt. Jour. Linn. Soc. 12: 207. 1869.

Plants attached in dense masses to twigs and branches, brown below, bright golden-green above; secondary stems up to 3 cm. or more long, densely foliate; leaves somewhat contorted and slightly spreading from a nearly erect base when dry, erect-spreading when moist, 6 mm. or more long on vigorous plants, lanceolate-linear, somewhat plicate, narrowly long-acuminate, serrulate at the apex and often half the distance from it, carinate at the base; costa excurrent into a dentate arista often ¼ the length of the leaf; upper median leaf-cells of stem and branch leaves 2–4 times as long as broad or even more elongate, smooth, very incrassate, arranged in clear lines; marginal cells in this region very narrowly long-linear, the other cells gradually elongating toward the base where they become narrowly linear, their lumen scarcely as wide as the cell walls, and usually sparingly papillose with comparatively low papillae, the basal often colored; perichaetial leaves rather shorter, more abruptly long-acuminate, all their cells narrowly linear; seta up to 1 cm. long, smooth or sometimes bearing a few low papillae in the upper part; capsules globose-pyriform, not quite 2 mm. long, the urn smaller at the mouth, often slightly ribbed; calyptra without hairs; operculum hemispheric, the beak needle-like, more than 1 mm. long; peristome double, about 0.4 mm. long, the teeth more or less united, truncate, striate-papillose; inner peristome membranous, rather irregularly divided, as long as the outer, papillose; spores finely papillose, variable in size, up to 25 μ in diameter, maturing in winter.

TYPE: Jamaica (*Wilds;* cotype seen).
DISTRIBUTION: Common in the West Indies, usually at considerable elevations.
NOTE: There is great variation in the cell structure of the leaves even on the same plant; in some there will be an area of almost isodiametric cells, in others the narrow marginal cells will be lacking. *Britton & Cowell 694* from St. Kitts has basal cells rather strongly tuberculate.

11. **Macromitirum Williamsi** E. Bartr. Contr. U. S. Nat. Herb. **26**: 84. 1928.

Primary stems creeping, bare; secondary stems erect, 15–20 mm. high, radiculose, branched, growing in rather loose, yellowish-green tufts, brown below; leaves flexuous and spirally contorted when dry, spreading when moist, 4–5 mm. long, linear-lanceolate, gradually long-acuminate and hair-pointed by the excurrent costa, carinate and lightly plicate below, denticulate in about the terminal half, the hair-point denticulate; upper leaf-cells elongate, smooth, in more or less distinct rows, of varying lengths up to 18 μ, mostly shorter, the marginal more elongate, the lumen flexuous, little wider than the incrassate, longitudinal walls, gradually elongate to the narrowly linear cells at the base, the outer basal cells much narrower than those near the costa, which often bear low, broad papillae; perichaetial leaves little differentiated, occasionally shorter and broader, the hair-point sometimes longer, smooth; autoicous; seta red,

bearing a few papillae in the type, more in some other plants, 8–10 mm. long; capsules obovoid, smooth, the urn over 1 mm. long; calyptra smooth; operculum rostrate, about as long as the urn; peristome double, of concentric, papillose cylinders about 75 μ high, the outer split about ¼ the distance from the apex, the inner paler, irregularly cleft.

TYPE LOCALITY: On trees, La Hondura, Province of San José, Costa Rica, alt. 1300–1700 m. (*Standley 36405;* isotype seen).

DISTRIBUTION: Costa Rica, in the higher mountains; Puerto Rico (*Grout 63, Shafer 3060*); Guadeloupe (*Duss 631*); Martinique (*Duss 164, 166*).

ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 84, *f. 22*.

NOTE: *Macromitrium Rusbyanum* E. G. Britton (Bull. Torrey Club **23**: 482. 1896) resembles *M. Williamsi* in many ways but differs in that the upper median leaf-cells are often strongly and sharply mammillose and the narrow marginal cells lacking, and that the spores are very large, up to 86 μ in diameter. Type locality, Bolivia.

12. **Macromitrium fulgescens** E. Bartr.; Grout, Bryologist **47**: 12. 1944.

Macromitrium fuscescens E. Bartr. Contr. U. S. Nat. Herb. **26**: 89. 1928. Not *M. fuscescens* Schwaegr. 1827.

Primary stems creeping, rather rough with old abraded leaves; secondary stems erect, densely tufted, 5–6 cm. long, dark brown below, yellow-green above, branched, scarcely radiculose; leaves rather abruptly and widely flexuous-spreading from a short, suberect, slightly plicate base when moist, crisped and contorted when dry, 7–10 mm. long, linear-lanceolate, gradually long-filiform-acuminate, more or less falcate toward the ends of the branches, carinate, rather sharply denticulate toward the apex, sinuate-denticulate in the median and lower portions; costa excurrent into a long, flexuous, denticulate hair-point; upper leaf-cells short, elliptic to isodiametric or rounded-quadrate, rarely more than twice as long as broad, often a little longer on the margins, smooth, in more or less apparent rows; lower cells long and narrow, smooth, the walls thick, pitted, yellowish, the marginal half much longer and narrower; sporophyte unknown.

TYPE LOCALITY: On tree, La Palma, Province of San José, Costa Rica, alt. about 1800 m. (*Standley 38011*).

DISTRIBUTION: Costa Rica; Guadeloupe (*Duss 695, 1613*, distributed as *M. vernicosum* Schimp.).

ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 89.

13. **Macromitrium flavopilosum** R. S. Williams, Bull. Torrey Club **38**: 34. 1911.

Plants in rather loose mats with bare or tomentose creeping stems; secondary stems rather distant, robust, up to 2 cm. high, often somewhat divided; leaves crowded, spreading-flexuous, slightly undulate, the upper 8–9 mm. long, narrowly lanceolate, smooth on both sides, gradually or abruptly tapering into a long, smooth hair-point ⅓–⅔ the length of the blade, the margins plane and serrulate above; all leaf-cells incrassate, elongate, the upper oblong, 10–20 μ long, 2–5 times as long as broad, the lower narrowly linear, narrower at the margins, smooth or with a few low, broad papillae; perichaetial leaves not much different but apt to be more abruptly narrowed to the hair-point, their upper cells shorter instead of longer; pseudautoicous; seta smooth, about 1 cm. long; capsules obovoid, the urn scarcely 2 mm. long, smooth; calyptra without hairs, rough at the apex; operculum convex, the beak slender, straight, ⅔ the length of the urn; peristome double, papillose, the outer a low cylinder with an irregular margin, the inner a little higher; spores up to 30 μ in diameter.

TYPE LOCALITY: Cana, Province of Darien, Panama (*Williams 1063* in herb. N. Y. Bot. Gard.).

DISTRIBUTION: Known only from the type locality.

NOTE: Though Mr. Williams, did not mention it, many of the leaves are abruptly rounded to the hair-point. The low papillae on the leaf-bases seem to be few and not present on all leaves.

14. **Macromitrium fusco-aureum** E. Bartr. Contr. U. S. Nat. Herb. **26**: 83. 1928.

Secondary stems robust, in dense tufts up to 6 cm. long, not radiculose, reddish-brown below, lurid yellowish-green above; leaves widely flexuous-spreading and somewhat contorted

when dry, abruptly squarrose-spreading from an erect, plicate, clasping base when moist, 8–10 mm. long, narrowly linear-lanceolate, gradually narrowed to a long hair-point consisting mainly of the strongly dentate, excurrent costa and up to ⅓ the length of the leaf, the basal margins recurved, the upper plane and serrulate; leaf-cells all elongate, smooth, the upper 25–40 μ long, their lateral walls incrassate, pitted, as broad as the lumen, gradually elongate to the much longer, somewhat colored basal cells; probably dioicous; seta 2 cm. long; capsules cylindric, 2 mm. long; peristome and spores not seen.

TYPE LOCALITY: On trees, Cerros de Zurqui, northeast of San Isidoro, Province of Heredia, Costa Rica, alt. 2000–2400 m. (*Standley & Valerio 50493;* type in herb. Bartram examined).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 83.

15. **Macromitrium Standleyi** E. Bartr. Contr. U. S. Nat. Herb. **26**: 85. 1928.

Primary stems creeping, 15 cm. long or longer, slender, not radiculose, their leaves appressed, or secund at the ends; secondary stems not crowded, mostly unbranched, about 2 cm. long, tawny, rather densely foliate; leaves flexuous-spreading when dry and often somewhat secund, up to 18 mm. long, narrowly linear-lanceolate, very gradually narrowed to a long, filiform acumination, the margins undulate-crisped in the upper ⅔, ciliate-dentate in the upper half, denticulate nearly to the base; costa red, excurrent into a long, denticulate hair-point; leaf-cells elongate, the upper and median about 40 μ long, the lumen scarcely as wide as the incrassate, pitted longitudinal walls, longer and narrower toward the margins and gradually elongate to the very long, narrow, yellowish, tuberculate basal cells; perichaetial leaves shorter, the hair-point up to half their length, their upper cells much longer and narrower; autoicous; seta about 2 cm. long, red, smooth; capsules globose-pyriform, about 1.75 × 1.5 mm., abruptly contracted to a short, sulcate neck; calyptra smooth; peristome evidently double (but the capsules examined old and operculum and spores lacking).

TYPE LOCALITY: Cerro de las Caricias, Province of Heredia, Costa Rica, alt. 2000–2400 (*Standley & Valerio 52147;* type in herb. Bartram examined).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 85.

Macromitrium Standleyi var. **subundulatum** E. Bartr. Contr. U. S. Nat. Herb. **26**: 86. 1928. Leaves of secondary stems more strongly secund, less strongly undulate above, merely denticulate on the upper margins; leaf-cells much shorter. TYPE LOCALITY: Cerro de las Caricias, Province of Heredia, Costa Rica, alt. 2000–2400 m. (*Standley & Valerio 52096*). DISTRIBUTION: Known only from the type locality. ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 86, *f. 24*.

16. **Macromitrium subcirrhosum** C. Müll. Bot. Zeit. **20**: 373. 1862.

Plants in wide mats; secondary stems 3–7 cm. long, not radiculose, densely foliate; leaves spreading-flexuous and often somewhat crispate when dry, erect-spreading when moist, long-lanceolate from an oblong base, gradually and slenderly long-subulate-acuminate, somewhat plicate, carinate, the margins entire and recurved below, plane and sharply serrate above; leaf-cells incrassate, the upper short-oblong, somewhat elongate and flexuous, usually oblique to the costa, gradually elongating to the narrowly linear, more or less tuberculate basal area; outer perichaetial leaves having the costa excurrent into a long, subentire hair-point, the inner often shorter; monoicous; seta 12–25 mm. long, smooth; capsules obovoid, smooth, the urn including the short, plicate neck about 2 mm. long; calyptra hairless; operculum not seen; (old and broken) peristome double.

TYPE LOCALITY: Costa Rica, forest of Barba facing the Pacific, alt. 2300–2700 m. (*Pittier 5543;* isotype in herb. N. Y. Bot. Gard.).
DISTRIBUTION: Abundant in Costa Rica (16 collections in herb. Bartram).
NOTE: Cardot (Bull. Soc. Bot. Belg. **31**[1]: 155. 1892) states that the antheridial buds are on the upper face of the lower leaves. The elongate, oblique leaf-cells are very characteristic.

17. **Macromitrium perichaetiale** (Hook. & Grev.) C. Müll. Bot. Zeit. **3**: 544. 1845.

Orthotrichum perichaetiale Hook. & Grev. Edinb. Jour. Sci. **1**: 127. 1824.
Schlotheimia perichaetialis Schwaegr. Suppl. **2²**: 56. 1826.
Leiotheca perichaetialis Brid. Bryol. Univ. **1**: 731. 1826.
Macromitrium truncatum C. Müll. Linnaea **17**: 383. 1843.

Plants brownish-green throughout; secondary stems 1–2 cm. long; leaves erect-spreading when moist, closely appressed when dry, very little contorted, up to 3 mm. long, typically truncate and mucronate by the excurrent costa, somewhat plicate, the margins entire and usually recurved below on one side; leaf-cells all long and narrow, the lumen scarcely as wide as the thick lateral walls, the upper 20–30 μ long, the basal 2–3 times as long, their transverse walls thinner; perichaetial leaves long, narrowly acuminate to hair-pointed by the excurrent costa; seta smooth, up to 15 mm. long; capsules oblong to obovoid, usually narrower at the mouth than in the middle, the urn including the neck up to 2 mm. long; calyptra hairy; peristome double, the outer teeth truncate, somewhat united at the base, shorter than the narrowly linear segments, of only one row of cells from a narrow basal membrane, all its parts strongly papillose.

TYPE LOCALITY: St. Vincent Island, British West Indies.
DISTRIBUTION: On shrubs and trees; West Indies.
ILLUSTRATIONS: Edinb. Jour. Sci. **1**: *pl. 6;* Schwaegr. Suppl. **2²**: *pl. 169;* E. & P. Nat. Pfl. ed. 2. **11**: *f. 456.*
NOTE: A specimen in herb. U. S. Nat. Mus. from Puerto Rico, determined by C. Müller as *M. truncatum*, is definitely *M. perichaetiale.*

18. **Macromitrium costaricense** E. Bartr. Contr. U. S. Nat. Herb. **26**: 88. 1928.

Plants in dense tufts, brownish below, yellowish-green above; secondary stems erect, branched, somewhat radiculose below, about 2 cm. high; leaves cirrhate-crisped when dry, flexuous-spreading when moist, about 3 mm. long, linear-lanceolate, short-acuminate, serrulate only toward the apex, carinate and slightly plicate below; costa excurrent into a short, denticulate point; upper leaf-cells rounded-quadrate to oblong, not very thick-walled, 7–10 μ in their longest dimension, smooth, in not very apparent rows; median cells more elongate, the lower long and narrow with thick, yellowish, sinuate walls, smooth or with a few low, rounded papillae; perichaetial leaves about 4 mm. long, narrower and more slenderly acuminate than the stem leaves, their cells more elongate, their costa longer-excurrent; ? autoicous; seta 8–10 mm. long, smooth or bearing a few low papillae; capsules ovoid, contracted to a short, sulcate neck, the urn about 1.5 mm. long; calyptra smooth, deeply laciniate; operculum rostrate, a little shorter than the urn; peristome double.

TYPE LOCALITY: On tree, La Palma, Province of San José, Costa Rica (*Standley 30823;* type in herb. Bartram examined).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 88.
NOTE: Distinguished from *M. cirrosum* and its near allies by the more abruptly acuminate leaves which have the basal cells nearly smooth.

19. **Macromitrium mammillosum** E. Bartr. Contr. U. S. Nat. Herb. **26**: 87. 1928.

Secondary stems in loose, erect tufts, branched above, dark brown below, yellowish-green above, 5–6 cm. high; leaves flexuous-crisped when dry, erect-spreading when moist, 2.5–3 mm. long, lanceolate, acuminate, lightly plicate, carinate, serrulate through about the terminal half; costa percurrent or vanishing just below the apex; upper leaf-cells elliptic to subcircular, about 15 μ long near the costa, very incrassate, in more or less apparent rows, smaller near the margins, strongly mammillose on both sides; cells of the lower third of the leaf gradually elongate to narrowly linear near the base, narrower toward the margins, smooth or bearing a rounded papilla of varying size on the upper surface; perichaetial leaves similar but longer and more slenderly acuminate; ? autoicous; seta 12–15 mm. long, smooth; urn of the capsule about

2 mm. long, globose-pyriform, smooth, abruptly contracted to a short, sulcate neck; calyptra smooth, deeply laciniate; operculum and peristome unknown.

TYPE LOCALITY: On tree, Cerros de Zurqui, Province of Heredia, Costa Rica, alt. 2000–2400 m. (*Standley & Valerio 50384*).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 87.

NOTE: *M. attenuatum* Hampe; Triana & Planch. (Ann. Sci. Nat. V. **4**: 329. 1865) from Colombia is very close to this species and may prove to be the same. Two other closely related species from South America, *M. proliferum* Mitt. (Jour. Linn. Soc. **12**: 217. 1869) and *M. runcinatella* C. Müll. (Linnaea **42**: 488. 1879), appear to be the same. They differ from *M. mammillosum* chiefly in the very coarsely serrate leaves.

20. **Macromitrium serrulatum** Mitt. Jour. Linn. Soc. **12**: 215. 1869.

Macromitrium verrucosum E. Bartr. Contr. U. S. Nat. Herb. **26**: 82. 1928.

Plants in rather dense tufts, brownish and radiculose below, yellowish-green above; secondary stems erect, dichotomously branched, 3–4 cm. high; leaves cirrhate-crisped when dry, squarrose-spreading when moist, 2.5–3 mm. long, oblong-lanceolate, acute to short-acuminate, carinate, the margins undulate and serrulate about ⅓ of the distance from the apex, plane and entire below; costa nearly or quite percurrent; upper leaf-cells rounded, subcircular to somewhat longer than broad, about 12 μ in diameter, often larger toward the costa and smaller toward the margins, strongly mammillose on both surfaces, near the base becoming elongate to linear, verrucose with high, conical papillae or tubercles; perichaetial leaves similar, their upper cells longer and less strongly mammillose; seta about 1 cm. long, smooth; capsules ovoid, the urn about 2 mm. long, tapering to a short neck, distinctly 6–7-ribbed through its whole length; calyptra lacking hairs, somewhat papillose at the apex, deeply laciniate; operculum slenderly rostrate, about as long as the urn; peristome double, of two concentric cylinders, about 225 μ high, irregularly cleft on the edges; spores papillose, up to 30 μ in diameter.

TYPE LOCALITY: In Monte Tunguragua, Ecuador, alt. 7000 ft. (*Spruce 97*).
DISTRIBUTION: Mexico; Guatemala; Costa Rica; South America.
ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 82.

21. **Macromitrium guatemalense*** C. Müll. Syn. **2**: 644. 1851.

Macromitrium Trianae C. Müll. Bot. Zeit. **15**: 580. 1857.
Macromitrium penicillatum Mitt. Jour. Linn. Soc. **12**: 217. 1869.
Macromitrium tortuosum Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 189. 1872.
Macromitrium paucidens C. Müll. Linnaea **42**: 487. 1879.
Macromitrium rhystophyllum C. Müll. Bull. Herb. Boiss. **5**: 198. 1897.
Macromitrium subreflexum C. Müll. Bull. Herb. Boiss. **5**: 198. 1897.

Plants robust, in dense, wide, dark green mats, lighter green at the growing points; secondary stems radiculose below, densely foliate, up to 2 cm. long, somewhat branched; leaves strongly crisped when dry, erect-spreading to somewhat recurved when moist, about 2 mm. long, oblong-lanceolate to lanceolate, strongly keeled, rather broadly but sharply acute, the margins sharply toothed near the apex to nearly entire, often with coarse, hyaline teeth at and near the insertion, undulate above and recurved below, at least on one side; costa nearly or quite percurrent; upper leaf-cells rounded-quadrate, 5–7 μ in diameter, more or less mammillose, gradually merging into the linear, very strongly tuberculate basal cells, all strongly incrassate; outer basal cells narrowly linear, mostly smooth; perichaetial leaves narrowly long-acuminate, smooth, entire, the upper cells elongate; dioicous; seta smooth, up to 6 mm. long; capsules ovoid, strongly ribbed when dry, becoming smoother with age, the urn up to 2 mm. long; calyptra without hairs, covering most of the capsule, deeply laciniate; operculum slenderly rostrate from a conical base, shorter than the urn; peristome double, the outer a truncate cone of well developed teeth more or less united but each showing a median line, transversely segmented, papillose; inner peristome a divided membrane of equal length; spores about 25 μ in diameter, finely papillose.

* as "guatemaliense"; here regarded as an orthographic error.

TYPE LOCALITY: Guatemala (? *Frederichsthal*, comm. Kegel; specimens so labeled and in addition "M. guatemalense mihi" in herb. N. Y. Bot. Gard. have been examined).

DISTRIBUTION: On twigs and bark, occasionally on rock; Mexico; Central and South America; Galapagos Islands (*Alban Stewart 8713b* in herb. N. Y. Bot. Gard.).

NOTE: The upper leaf-cells are somewhat mammillose, though described by Müller as smooth. Of *M. subreflexum* Müller says that the capsules are smooth, but at maturity they are very plainly sulcate, becoming nearly smooth with age. Specimens of *M. tortuosum* determined by Bescherelle and others determined by Thériot are certainly *M. guatemalense*. The type has not been seen. What seems to be an isotype of *M. penicillatum* agrees in all observed respects with *M. guatemalense*, except that the calyptra has a very few short hairs, scarcely visible except under high magnification. The *M. p[illegible]dens* studied was Fendler's Musci Venezuelenses *54* (det. C. Müller and marked "n. sp."), in herb. N. Y. Bot. Gard.

22. **Macromitrium punctatum** (Hook. & Grev.) Brid.
Bryol. Univ. 1: 739. 1826.

Orthotrichum punctatum Hook. & Grev. Edinb. Jour. Sci. **1**: 119. 1824.
Schlotheimia brachyrhyncha Schwaegr. Suppl. 2^2: 53. 1826.
Macromitrium contextum Hampe; Triana & Planch. Ann. Sci. Nat. V. **4**: 331. 1865.
Macromitrium Sumichrasti Duby, Mém. Soc. Phys. Hist. Nat. Genève **19**: 297. 1868.
Macromitrium reflexifolium Mitt. Jour. Linn. Soc. **12**: 211. 1869.
Macromitrium liberum Mitt. Jour. Linn. Soc. **12**: 214. 1869.
Macromitrium Sartorii C. Müll. Linnaea **38**: 641. 1879.

Plants cespitose; secondary stems 2–3 cm. long, sparingly branched; leaves loosely appressed with contorted-crisped upper portions when dry, spreading-reflexed when moist, 2 mm. or more long, oblong-lanceolate to ligulate, strongly keeled, the margins entire below except for frequent hyaline teeth at the base, more or less reflexed, often rugulose above, strongly dentate-serrate at and near the broadly acute to obtuse apex; costa percurrent to very shortly excurrent; upper leaf-cells subcircular, bulging, very incrassate, 5–7 μ in diameter, below the middle gradually elongating to the narrowly linear basal-marginal cells, which are mostly smooth; median basal cells occupying $\frac{2}{3}$ the base of the leaf, oblong, 2–4 times as long as broad, grossly tuberculate-papillose, all very incrassate; a small area of smooth, hyaline, rather thin-walled cells often present near the costa at the insertion; perichaetial leaves ovate-lanceolate, entire to denticulate near the apex, the costa not excurrent, the leaf-cells elongate; dioicous; seta up to 1 cm. in length; capsules obovoid, thickest in the middle, the neck short, smooth to plicate depending on age and condition, the urn less than 2 mm. long; calyptra smooth (in the type); operculum rostrate; peristome double, the outer of 16 rather truncate, more or less united teeth, the inner a membrane of varying height.

TYPE LOCALITY: Brazil.

DISTRIBUTION: Mexico; Central and South America; the West Indies.

ILLUSTRATIONS: Edinb. Jour. Sci. **1**: *pl. 5;* Schwaegr. Suppl 2^2: *pl. 168*.

NOTE: Mitten states that the capsules of *M. Sumichrasti* are very smooth and those of *M. reflexifolium* are plicate, but in some specimens that seemed to belong here there were capsules of both sorts, depending upon their age and condition. The description has been drawn largely from an isotype of *M. reflexifolium*. The type of *M. Sartorii* has not been available, but specimens from Mexico, collected by Sartorius, determined by Bescherelle, in herb. N. Y. Bot. Gard., clearly belong here. It seems quite possible that further collections may prove that *M. crassirameum* C. Müll. (Nuov. Giorn. Bot. Ital. II. **4**: 125. 1897) and *M. atroviride* R. S. Williams (Bull. N. Y. Bot. Gard. **3**: 131. 1905) are also synonyms of *M. punctatum*. The only observable difference of import between the types of these seemed to be that the inner peristome of *M. crassirameum* was better developed or perhaps less broken. The distinctions between *M. punctatum* and *M. guatemalense* are very hard to define. There is little difference in the slenderness of the leaves in the types, but the leaves of the latter are finely serrate and the peristome-teeth more abruptly truncate, with denser, more bulging segments. *Spruce 108*, which Mitten cites as typical *M. punctatum*, fits the above description very closely. But Mrs. Blaghorne's Colombian plant which he cites first has the long, slender leaves of *M. crassirameum*, though these are only finely serrate at the apex.

23. **Macromitrium pentastichum** C. Müll.
Linnaea **21**: 186. 1848.

Macromitrium dentatulum C. Müll. Hedwigia **37**: 237. 1898.
Macromitrium hirtellum E. Bartr. Contr. U. S. Nat. Herb. **26**: 86. 1928.

Plants in "rather loose, yellowish green tufts" (according to Bartram); secondary stems erect, sparingly branched, about 2 cm. high, radiculose at the base; leaves erect and flexuous-

contorted when dry, flexuous-spreading when moist, about 3 mm. long, oblong-lanceolate, shortly acuminate, carinate, serrulate through about the terminal half; costa short-excurrent; upper leaf-cells rounded-quadrate to subcircular, up to 12 μ in diameter, in more or less apparent rows, hardly incrassate, mammillose on both faces, gradually elongating in the basal ¼ to the linear, smooth basal cells; perichaetial leaves up to 5 mm. long, linear-lanceolate, abruptly contracted to a linear, denticulate hair-point consisting mainly of the excurrent costa, the cells of the lower ⅔ elongate; autoicous, some of the antheridial buds gemmiform on the ventral side of the costa of the older leaves; seta 6–8 mm. long, smooth; capsules globose-pyriform, the urn not quite 2 mm. long, smooth except for the short, sulcate neck; calyptra laciniate at the base, long-pilose; operculum about 1 mm. long, abruptly rostrate; peristome double, the outer of strongly papillose teeth which are scarcely separated, the inner a papillose membrane of about the same height.

TYPE LOCALITY: On branches of trees in moist dark woods, Surinam (*Kegel*).
DISTRIBUTION: Mexico; Costa Rica; British Honduras; the West Indies; South America.
ILLUSTRATION: Contr. U. S. Nat. Herb. **26**: 86, *f. 25*.
NOTE: Types of *M. hirtellum* only have been seen; a specimen of *M. pentastichum* cited by Mitten (Jour. Linn. Soc. **12**: 209) has been carefully compared.

24. **Macromitrium Richardi** Schwaegr.

Suppl. **2**[2]: 70. 1826.

Macromitrium didymodon Schwaegr. Suppl. **2**[2]: 138. 1827.
Macromitrium goniopodium Mitt. Jour. Linn. Soc. **12**: 198. 1869.
Macromitrium rhabdocarpum Mitt. Jour. Linn. Soc. **12**: 199. 1869.
Macromitrium insularum Mitt. Jour. Linn. Soc. **12**: 200. 1869. Not *M. insularum* Sull. & Lesq. 1859.
Macromitrium leptophyllum Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 190. 1872.
Macromitrium domingense Jaeger, Ber. St. Gall. Nat. Ges. **1872-1873**: 149. 1874.
Macromitrium tenellum Card. Rev. Bryol. **36**: 109. 1909.

Plants in wide, thin mats, yellowish-green above, brownish below; secondary stems up to 4 cm. high, branching, densely foliate; leaves strongly crisped when dry, erect-open and often incurved when moist, reaching 1.6 mm. in length, ligulate-lanceolate, acute to obtuse and apiculate, occasionally subcucullate at the apex, carinate, plicate near the costa, the margins plane or somewhat revolute, finely crenulate above by mammillae; upper leaf-cells rounded-oval to subcircular, incrassate, 7–12 μ in diameter, strongly mammillose on both sides, gradually changing to the relatively short area of smooth basal cells, which are elongate, oblong to linear, their pitted walls nearly as wide as the lumen; costa strong, ending just below the apex to very shortly excurrent into the apiculus, covered in the upper part on the inner face only with mammillose cells like those of the lamina; perichaetial leaves longer and broader at the base, gradually acute, smooth throughout, the upper cells more or less elongate; monoicous; seta smooth and erect, up to 2 cm. long, usually shorter; capsules oblong-ovoid to oblong-cylindric, narrowed at both ends, erect and symmetric, striate when dry and empty (especially at the base), up to 1.5 mm. long; calyptra with very few inconspicuous hairs, covering the entire capsule; operculum subulate; peristome single, the teeth short, pale, papillose, fragile, more or less united in pairs, rather indistinctly transversely striate; spores finely papillose, up to 25 μ in diameter, maturing in December.

TYPE LOCALITY: Brazil.
DISTRIBUTION: On the bark of shrubs and trees; Florida; Mexico; Central and South America; the West Indies.
ILLUSTRATIONS: Schwaegr. Suppl. **2**[2]: *pl. 173, 190;* Grout, Moss. Fl. N. Am. **2**: *pl. 62B.*
NOTE: Plants from Guadeloupe and Puerto Rico have been identified by others as *M. fimbriatum* (Beauv.) Schwaegr. (Suppl. **2**[1]: 37. 1824. *Orthotrichum fimbriatum* Beauv. Prodr. 80. 1805). This Bridel (Bryol. Univ. **1**: 735. 1826) states is identical with *M. uncinatum* Brid. (Bryol. Univ. **1**: 308. 1826). There is good reason to believe that *M. uncinatum* is a synonym of *M. Richardi,* as is stated in Bryologist **47**: 15 (1944). Since the types of both *M. uncinatum* and *M. fimbriatum* were from African Islands and are not available, it seems best not to include them in synonymy; to do so would make *M. fimbriatum* the oldest name. Gardener's plants from Rio de Janeiro in herb. N. Y. Bot. Gard., cited by Mitten as type of *M. Richardi,* have a smaller area of linear basal cells than much material referred to *M. didymodon,* but are essentially the same. *Burchell 1003* from Brazil, type of *M. goniopodium,* has the leaves strongly incurved when moistened. This tendency is common in *M. Richardi,* but in these specimens it reaches its extreme.

25. **Macromitrium Podocarpi** C. Müll.
Bull. Herb. Boiss. **6**: 96. 1898.

Plants in dense mats on trees and shrubs, brownish-green; secondary stems about 1 cm. long, sparingly branched, densely tomentose below; leaves strongly crisped when dry, open-flexuous when moist, up to 2.25 mm. long, narrowly lanceolate, acute to apiculate, entire, deeply canaliculate, often slightly undulate; costa strong, nearly or quite percurrent; upper leaf-cells subcircular, about 6 μ in diameter, incrassate, bulging to somewhat mammillose, gradually elongating in the lower third into the oblong to linear basal cells, oblong and tuberculate near the costa, linear and smooth near the margins; perichaetial leaves rather shorter; dioicous; seta about 5 mm. long, smooth; capsules obovoid, ribbed and contracted under the mouth when dry, the urn including the short neck 1.5 mm. long; calyptra smooth, deeply laciniate; operculum rostrate; peristome double, the outer of somewhat united, truncate teeth, the inner a lighter-colored membrane of about the same length; spores minutely roughened, about 15 μ in diameter.

TYPE LOCALITY: Serra Itabria de Campo, Minas Geraës, Brazil (*Ule 1066*, issued as Bryoth. Brasil. *227*.)

DISTRIBUTION: South America; Costa Rica (*Standley 4167* in herb. N. Y. Bot. Gard.; *52602* in U. S. Nat. Herb.); Honduras (*Yuncker* et al. in herb. Bartram).

26. **Macromitrium portoricense** R. S. Williams,
Bryologist **32**: 69. 1929.

Plants in wide, dense, rather thin mats on rocks; primary stems several cm. long, trailing, tomentose, bearing crowded, erect branches up to 1.5 cm. long, the branchlets short, 2–3 mm. long; stem-leaves very crispate when dry, erect-spreading when moist, 2 mm. long or less, oblong-lanceolate, keeled, rather broadly acute, the margins slightly crenulate above, plane or nearly so in the upper half; costa nearly percurrent to slightly excurrent, smooth on the back; leaf-cells incrassate, up to 10 μ long, nearly isodiametric to below the middle of the leaf, strongly mammillose on both sides, gradually changing into the elongate basal cells, which are narrowly linear except those near the costa and a single row of broad marginal cells near the base; basal cells bearing a considerable number of large, tubercle-like papillae; perichaetial leaves shorter and broader, the cells all more or less elongate, smooth except at the apex; no antheridia found; seta about 6 mm. long, smooth; capsules obovoid, the urn about 1.5 mm. long, smooth; calyptra without hairs, somewhat rough at the apex; stomata in 2 rows near the base of the capsule, superficial; peristome present (but in the specimens examined too old for description); spores smooth, 16–20 μ in diameter.

TYPE LOCALITY: On the road between Maricao and Monte Alegrillo, Puerto Rico, alt. 500–900 m. (*E. G. Britton 2638*).

DISTRIBUTION: Known only from the type locality.

NOTE: The author compares this to *M. insularum* Mitt., but to me it seems much closer to *M. guatemalense*, since some of the leaves have teeth on the basal marginal cells.

27. **Macromitrium fragilicuspis** Card.
Rev. Bryol. **36**: 109. 1909.

Plants dark green throughout; secondary stems stout, freely branching, the branches short, densely foliate; leaves appressed and contorted-crispate when dry, spreading from an appressed base when moist, lanceolate-ligulate, plicate near the costa, entire, the margins recurved in the median portion, abruptly narrowed at the apex to a rather broad, brittle apiculus difficult to find in place; costa percurrent; upper leaf-cells rounded-quadrate to short-oblong, 5–7 μ long, smooth, incrassate, in the basal third of the leaf gradually merging into the elongate basal cells, which are narrowly linear at the margins, broader and shorter near the costa, with many tubercle-like papillae; seta 5–6 mm. long, smooth; capsules erect or subinclined, oblong-ovate, deeply plicate when dry, somewhat wider at the mouth; operculum and calyptra not seen; peristome imperfect, apparently an irregular, papillose membrane.

TYPE LOCALITY: Near Jalapa, Vera Cruz (*Pringle 15168*).
DISTRIBUTION: Mexico; Guatemala (*Standley 80664, 32532*).

28. **Macromitrium clavatum** Schimp.; Jaeger, Ber. St. Gall. Nat. Ges. **1872-1873**: 137. 1874 (nomen nudum); Grout, Bryologist **47**: 16. 1944.

Leaves lingulate-lanceolate, 1.5–2 mm. long, broadly acute, carinate, the margins entire, recurved at the base; costa vanishing below the apex, strong; upper leaf-cells incrassate, 6–8 μ in their longest dimension; lower linear cells extending to the middle of the leaf; perichaetial leaves acute, their upper cells elongate; seta 8–9 mm. long, smooth; capsules ovoid, the urn about 2 mm. long; peristome-teeth obtuse, papillose; no inner peristome observed.

TYPE LOCALITY: Guadeloupe (*L'Herminier;* type in herb. N. Y. Bot. Gard.).
DISTRIBUTION: Known only from the type locality.
NOTE: Similar to *M. Richardi* Schwaegr., but differs in having the linear basal cells extending half-way up the leaf and the upper cells smooth.

29. **Macromitrium pellucidum** Mitt. Jour. Linn. Soc. **12**: 203. 1869.

Macromitrium laevifolium Mitt. Jour. Linn. Soc. **12**: 203. 1869.

Plants with the general habit of *Craspedophyllum mucronifolium*, but more robust, dark green throughout; secondary stems short, up to 1 cm. or more long, branching; leaves appressed and slightly contorted when dry, occasionally reaching 2 mm. in length, elongate-lingulate, the apex recurved, shortly apiculate by the excurrent costa, longitudinally plicate, the margins plane, entire; upper leaf-cells rounded, the marginal circular, minute, those nearer the costa elongate, short-oblong, incrassate, up to 29 μ long, gradually more elongate downwards to a large basal area of narrowly linear cells; perichaetial leaves narrowly acute, the upper cells all much elongate; seta smooth, up to 8 mm. long; capsules oblong-cylindric, the urn up to 2 mm. long (specimens examined old and other characters of the sporophyte lacking); operculum subulate, calyptra sparsely hairy, according to Mitten.

TYPE LOCALITY: On trees, Panuré, Uaupes River, Colombia (*Spruce 80;* type in herb. N. Y. Bot. Gard.).
DISTRIBUTION: Trinidad (*Fendler*); Venezuela (*Spruce 103*); Brazil (*Ynez Mexia 6038*); British Guiana (*Richards 287*); Colombia.
NOTE: Mitten states that *M. pellucidum* is near *M. laevifolium* but has narrower leaves with recurved apex; Mitten's type of the latter has many recurved leaf-apices, but this is not so general as in his type of the former.

30. **Macromitrium parvirete** E. Bartr.; Grout, Bryologist **47**: 16. 1944.

Plants densely cespitose, yellowish-green, not glossy; branches up to 2 cm. long, obtuse, densely foliate; leaves erect when dry, appressed-contorted, incurved at the apex, squarrose-spreading when moist, about 2 mm. long, ligulate from an oblong-ovate base, obtuse, mucronate, the upper margins plane, minutely crenulate, the lower somewhat recurved; costa shortly excurrent; upper leaf-cells small, obscure, rounded, 6–8 μ in diameter, not incrassate, strongly mammillose; basal cells linear, strongly tuberculate; perichaetial leaves small, ovate-lanceolate, acute, the costa percurrent; seta smooth, 6 mm. long; capsules short-urceolate, smooth, the urn about 1 mm. long; calyptra lacking hairs, deeply laciniate; operculum 1 mm. long, rostrate from a conical base; peristome simple, about 135 μ high, the teeth attached one to another, irregularly divided above, papillose; spores papillose, 35 μ in diameter.

TYPE LOCALITY: Costa Rica, between Río Jesus and Calera de San Ramón (Brenes *17075*, type, in herb. Chicago Mus. Nat. Hist.; *17073, 17078*).
DISTRIBUTION: Costa Rica; Colinas de San Remo (*Brenes 19077*); Aguas Claras, Miravalles (*Alfaro 131*); Tilarán (*Alfaro 175a*).
PLATE 4. *f. 18–24.*
NOTE: This species resembles *Craspedophyllum apiculatum* in gross appearance and in the ligulate, bluntly pointed leaves, but is distinguished from it and other species of *Craspedophyllum* by the elongate basal cells without trace of a differentiated border.

31. **Macromitrium altituberculosum** E. Bartr.; Grout, Bryologist **47**: 17. 1944.

Plants rather robust, in wide mats, dull olive-green, brown below; branches crowded, about 1 cm. high, obtuse, densely foliate, reddish-tomentose below; leaves appressed and spirally contorted when dry, spreading when moist, about 2 mm. long by 0.8 mm. wide, lingulate, concave, plicate, obtuse, short-mucronate, decurrent, the margins erect, crenulate above, tuberculate-toothed toward the insertion; costa strong, short-excurrent; upper leaf-cells rounded-hexagonal, not incrassate, 6–7 μ in diameter; basal cells narrowly rectangular, strongly tuberculate, at the decurrent basal angles densely armed with long spine-like tubercles; perichaetial leaves similar but acute, the costa percurrent; seta stout, 6 mm. long, smooth; capsules ovoid, the urn 2 mm. long, strongly ribbed when dry; calyptra naked, scabrous above, 3.5 mm. long; operculum 1–1.2 mm. long, conic-rostrate; peristome simple, the teeth to 240 μ long, densely and minutely papillose; spores papillose, to 30 μ in diameter.

TYPE LOCALITY: Guatemala, Sierra de las Minas, Dept. Zacapa, in oak-pine woods along the upper reaches of Río Sitio Nuevo, between Santa Rosalia and first waterfall, on rock, alt. 1200–1500 m. (*Steyermark 42274*).

PLATE 4. *f. 25–30.*

DISTRIBUTION: Known only from the type locality.

32. **Macromitrium Swainsoni** (Hook.) Brid. Bryol. Univ. **1**: 318. 1826.

Orthotrichum Swainsoni Hook. Musci Exot. *pl. 127.* 1820.

Secondary stems 5–10 mm. long, branching; leaves appressed and contorted when dry, erect-open when moist, 1.5–2 mm. long, oblong-lingulate to ovate, longitudinally plicate, rugose, the margins plane, entire; costa strong, percurrent to excurrent into a short mucro; leaf-cells all incrassate, the upper quadrate to rectangular, rounded, some almost circular, the others transversely elongate, more elongate and larger near the costa, still larger and longer at the base, up to 40 × 7 μ, the walls pitted; perichaetial leaves less plicate, more membranous; seta smooth, up to 1 cm. long; capsules ovoid, smooth (according to Hooker) or plicate (according to Mitten); calpytra hairless, deeply mitrate; operculum long-rostrate; columella long-exserted; peristome simple, of pale, linear, slender teeth, papillose, up to 0.3 mm. long, with a distinct median line, often split at the apex; spores papillose, up to 30 μ in diameter.

TYPE LOCALITY: Bahia, Brazil (*W. Swainson*).

DISTRIBUTION: On trunks and the branches of trees; Cuba; Mexico (*Pringle 767*); Guatemala (*Standley 70391*); Jamaica; Colombia; Brazil.

ILLUSTRATION: Hook. Musci Exot. *pl. 127.*

NOTE: Plants from the herbaria of Bridel and of Hornschuch are at the N. Y. Bot. Gard.

33. **Macromitrium dubium** Schimp. in C. Müll. Syn. **1**: 723. 1849.

Macromitrium vernicosum Schimp.; Besch. Ann. Sci. Nat. VI. 3: 202. 1876.

Secondary stems robust, branching, densely foliate; leaves 6–8 mm. long, narrowly lanceolate, gradually narrowed to a long, narrow apex, carinate at the base, the margins plane, distantly and faintly dentate above; costa percurrent; leaf-cells narrowly linear throughout, the incrassate cell walls nearly as wide as the lumen; perichaetial leaves shorter; seta smooth, up to 10 mm. long; capsules obovoid, the urn smooth, up to 2 mm. long; calyptra without hairs; operculum long-subulate; peristome apparently lacking.

TYPE LOCALITY: St. Kitts (type examined).

DISTRIBUTION: St. Kitts; Guadeloupe.

34. **Macromitrium Dussii** Broth. Symb. Ant. **3**: 424. 1903.

Plants densely cespitose; secondary stems about 1 cm. long, sparingly branched, densely foliate; leaves loosely appressed and contorted to somewhat crisped when dry, erect-open when moist, 3–4 mm. long, narrowly lanceolate, mostly abruptly apiculate, rarely slenderly acuminate, strongly plicate, smooth throughout, the margins plane or slightly revolute on one side of the base, mostly entire but occasionally slightly crenulate at the apex; costa percurrent to

shortly excurrent into the apiculus; leaf-cells incrassate, narrowly long-linear below, becoming shorter toward the apex where they are 13–25 × 5–6 μ and shorter on the margins; perichaetial leaves little different, or more slenderly acuminate and the upper cells longer and narrower; pseudautoicous, the male plants minute, rooted among the upper leaves; seta smooth, 1–1.5 cm. long; capsules ovoid to oblong-cylindric, widest in the middle, the urn about 2 mm. long; calyptra smooth; operculum rostrate; peristome simple, the teeth short, truncate, whitish, strongly papillose; spores 25–30 μ in diameter, papillose.

TYPE LOCALITY: On soil, Mt. Pelée, Martinique (*Duss 351* in herb. Berol.).
DISTRIBUTION: Martinique; Jamaica (*J. K. Brown 11171*); Cuba (*Shaffer 3736*).
NOTE: This species is almost unique in having all the leaf-cells nearly uniform except in length. It resembles *M. dubium* in leaf structure, differs in the abruptly apiculate leaves, their apical cells much shorter.

DOUBTFUL SPECIES

MACROMITRIUM CARIONIS C. Müll. Bull. Herb. Boiss. **5**: 199. 1897. No material available.
MACROMITRIUM PERPUSILLUM C. Müll. Linnaea **38**: 640. 1879. No material available.

9. **SCHLOTHEIMIA** Schwaegr. Suppl. 1²: 39. 1816.

Plants robust to slender, dark green, in more or less thick, wide mats. Primary stems long and creeping, with numerous erect or ascending secondary stems or branches which are usually densely foliate and often densely radiculose especially near the base. Leaves closely and often spirally appressed when dry, erect-open to subsquarrose when moist, mostly lingulate or lanceolate, entire and without border; costa strong, mostly percurrent to excurrent, with ventral guides; leaf-cells small, short above, usually elongate to linear below. Perichaetial and primary stem-leaves often quite different. Pseudautoicous. Capsules exserted (except in sect. *Stegotheca*), erect, symmetric, ovoid to cylindric, smooth to slightly ribbed. Calyptra campanulate, never plicate, usually smooth except at the apex, with a few basal lobes, usually covering most of the capsule. Peristome double, the teeth reflexed when dry, linear-lanceolate, papillose, reddish; segments of the endostome shorter, sometimes rudimentary.

Type species, *Schlotheimia torquata* (Hedw.) Brid.

Capsules immersed (Sect. 1. *Stegotheca*). — 1. *S. tecta.*
Capsules exserted (Sect. 2. *Ligularia*).
  Leaves strongly rugose above.
    Perichaetial leaves obtuse, mucronate, not much longer than the stem-leaves, often rugose. — 2. *S. rugifolia.*
    Perichaetial leaves much longer than the stem-leaves, not rugose. — 3. *S. torquata.*
  Leaves not or very slightly rugose.
    Leaves lanceolate or oblong, slenderly acuminate or mucronate.
      Leaves mucronate. — 4. *S. Hanseni.*
      Leaves acute to acuminate.
        Leaves oblong, short-acuminate. — 5. *S. sublevifolia.*
        Leaves lanceolate, gradually acuminate. — 6. *S. lancifolia.*
    Leaves lanceolate at the base, linear above. — 7. *S. angustata.*

Section 1. Stegotheca Mitt. Jour. Linn. Soc. **12**: 219. 1869. Sect. *Acuminella* C. Müll. Syn. **1**: 752, in part. 1849. Seta short; capsules immersed; calyptra short.

1. **Schlotheimia tecta** Hook. & Wils. Lond. Jour. Bot. **3**: 157. 1 Mr 1844.

Schlotheimia immersa C. Müll. Bot. Zeit. 2: 740. 25 0 1844.

Plants in dense, red-brown mats, green only at the tips of the new growth; secondary stems 3–4 cm. high, bearing short, stout branches above; leaves keeled and spirally twisted above when dry, spreading when moist, crowded, up to 3 mm. long, lanceolate, acuminate, the margins entire, plane, or slightly undulate; costa excurrent into a narrow point; leaf-cells smooth, incrassate, the outer and marginal portions of the lamina containing obliquely elongate, subrectangular cells, the marginal cells smaller, the juxtacostal oblong and less oblique, all gradually elongating to the linear basal cells, which have porose walls as wide as the lumen; perichaetial leaves up to 5–6 mm. long, rugose above, gradually narrowed to a slender, nearly entire upper portion which is nearly as long as the broader basal part; seta only 1 mm. long; capsules terminal or lateral by innovations, immersed, 2 mm. long, smooth, oblong-ovoid, dark brown; calyptra split at the base into 2–6 incurved lobes, rough at the apex, not covering the whole capsule; operculum rostrate; peristome double, the teeth with thickened striate sections,

the carinate segments shorter, paler, not thickened, striate above, papillose at the base; spores rough, 40 μ in diameter, maturing in spring.

TYPE LOCALITY: Serra das Orgãos, Brazil (*Gardener 71*).
DISTRIBUTION: On the limbs of trees; Jamaica (*Maxon 9794; Maxon & Killip 1172a; Nichols 193; E. G. Britton 124, 928, 1159; Harris 11124a; Shreve 928*); Brazil.

Section 2. Ligularia C. Müll. Syn. **1**: 754. 1849. Sect. *Euschlotheimia* Mitt. Jour. Linn. Soc. **12**: 219. 1869. Seta long; capsules exserted.

2. **Schlotheimia rugifolia** (Hook.) Schwaegr.
Suppl. **2**[1]: 150. 1824.

Orthotrichum rugifolium Hook. Musci Exot. *pl. 128*. 1820.
Orthotrichum Jamesoni Arn. Mem. Wern. Soc. **5**: 201. 1824.
Schlotheimia Jamesoni Brid. Bryol. Univ. **1**: 742. 1826.
Schlotheimia Merkelii Hornsch. in Mart. Fl. Bras. **1**[2]: 29. 1840.
Schlotheimia sinuata Hornsch. in Mart. Fl. Bras. **1**[2]: 31. 1840.
Macromitrium rugifolium C. Müll. Bot. Zeit. **3**: 543. 1845.
Schlotheimia Sullivantii C. Müll. Syn. **1**: 756. 1849.
Schlotheimia affinis C. Müll. Syn. **1**: 761. 1849.
Schlotheimia Oerstediana C. Müll. Syn. **2**: 648. 1851.
Schlotheimia patula Mitt. Jour. Linn. Soc. **12**: 225. 1869.
Schlotheimia ciliolata C. Müll. Bull. Herb. Boiss. **5**: 560. 1897.

Plants in wide, thin mats, dark green to almost black, lighter green at the growing tips; primary stems creeping, 3–5 cm. long, closely branching; branches 2–10 mm. long, erect, sparsely to freely branching, the older portions densely radiculose with papillose radicles; leaves of primary stems ovate-triangular, the others crowded, somewhat spirally twisted at the apex of the shoot, erect-spreading to slightly recurved when moist, about 1.5 mm. long, oblong-lingulate, mucronate at the rounded-obtuse apex by the slightly excurrent costa, strongly rugose above, more or less plicate longitudinally below; upper leaf-cells rounded-elliptic to subcircular, very incrassate, the lumen 6–8 μ in diameter, gradually elongated below to the linear basal cells whose lumen is no thicker than the cell walls, all smooth; perichaetial leaves variable, often somewhat longer than the others, more or less rugose, less abruptly mucronate to broadly acute, the upper cells elongate, oval to oblong-linear; monoicous; antheridial buds lateral; seta 2–4 mm. long; capsules oblong-cylindric, narrowed above, the urn 2 mm. or more in length, somewhat shriveled when dry and empty; calyptra covering the whole capsule, lobed and incurved at the base, resembling that of *Encalypta ciliata;* exothecial cells rectangular to linear, very incrassate; operculum long-rostrate; outer peristome-teeth 16, inserted below the mouth of the urn, linear, articulate, with a lighter median line, red-brown, finely papillose; segments of the inner peristome shorter, narrower, papillose; spores of various sizes, 15–35 μ in diameter.

TYPE LOCALITY: Jamaica.
DISTRIBUTION: Mostly on the bark of trees and shrubs; the southern United States, north to Tennessee; Mexico; Central and South America; the West Indies.
ILLUSTRATIONS: Schwaegr. Suppl. **2**[1]: *pl. 139;* Hook. Musci Exot. *pl. 128;* Sull. Ic. Musc. *pl. 38;* Mart. Fl. Bras. **1**[2]: *pl. 1;* Mém. Soc. Phys. Hist. Nat. **19**: *pl. 3.*
EXSICCATI: Drummond, So. Mosses *85;* Sull. Musci Allegh. *146;* Sull. & Lesq. Musci Bor. Am. *127;* ed. 2, *192;* Aust. Musci App. Suppl. *449;* Holz. Musci Acroc. Bor. Am. *161;* Small, Mosses So. U. S. *23;* Grout, N. Am. Musci Perf. *226;* Ren. & Card. Musci Am. Sept. Exs. *40, 40b;* Verdoorn, Musci Sel. & Crit. *238.*
NOTE: *Schlotheimia subleiophylla* C. Müll. (in Ule, Bryoth. Brasil. *17*) seems to differ mainly in the non-rugose leaves. Types of *S. Mohriana* C. Müll. (Linnaea **38**: 642. 1874) have not been available, but specimens so named from Guatemala at the N. Y. Bot. Gard. and from Jamaica at the Chicago Mus. Nat. Hist. are *S. rugifolia.*

3. **Schlotheimia torquata** (Hedw.) Brid.
Bryol. Univ. **1**: 323. 1826.

Hypnum torquatum Hedw. Sp. Musc. 246. 1801.
Neckera torta Sw. Fl. Ind. Occ. 1800. 1806.
Schlotheimia torta Schwaegr. Suppl. **1**[2]: 39. 1816.
Schlotheimia nitida Schwaegr. Suppl. **2**[2]: 151. 1826.
Schlotheimia Sprengelii Hornsch. in Mart. Fl. Bras. **1**[2]: 34. 1840.
Schlotheimia Pabstiana C. Müll. Bot. Zeit. **13**: 764. 1855.
Schlotheimia unguiculata Mitt. Jour. Linn. Soc. **12**: 226. 1869.
Schlotheimia Sartorii Schimp.; Besch. Mém. Soc. Sci. Nat. Cherb. **16**: 191. 1872.
Schlotheimia undato-rugosa C. Müll. Hedwigia **37**: 238. 1898.
Schlotheimia macrospora C. Müll. Bull. Herb. Boiss. **6**: 103. 1898.

Closely related to *S. rugifolia* and when sterile sometimes difficult to distinguish from it, but as a rule much more robust and having the elongate, oblique leaf-cells extending farther up along the costa; perichaetial leaves acute to long-acuminate, not rugose, always much longer than the stem leaves but varying in slenderness, in the length of the acumination, and in length up to 2.3 mm.

TYPE LOCALITY: The West Indies.
DISTRIBUTION: The West Indies; Mexico; South America.
ILLUSTRATIONS: Hedw. Sp. Musc. *pl. 63;* Schwaegr. Suppl. **2²**: *pl. 167.*
EXSICCATI: Ule, Bryoth. Brasil. *129* (as *S. Sprengelii*); Sull. Musci Cub. Wright. *52.*
NOTE: *Wright 52* (*S. undato-rugosa*) has perichaetial leaves merely acute, while in *Rothrock 4* from Jamaica they are long-linear-acuminate; but such differences in perichaetial leaves alone are scarcely sufficient to delimit species. *Schlotheimia pilomitria* C. Müll. (Nuov. Giorn. Bot. Ital. II. **4**: 127. 1897) from Bolivia is a very similar robust species, all its leaves obtuse, the mucro longer, the calyptra slightly hairy. Of *Schlotheimia pellucida* C. Müll. (Bull. Herb. Boiss. **5**: 561. 1897) no material has been available. By the author's statement it is closely related to *S. ciliolata* and *S. torquata.* The only tangible difference in the description is that the inner peristome is very short or obsolete. This may have been due to the characteristic brittleness of this organ in this group.

4. **Schlotheimia Hanseni** C. Müll.
Hedwigia **27**: 238. 1898.

Plants in dense mats, dark green, almost black below; secondary stems up to 1.5 cm. long, sparingly branched; leaves crowded, appressed and more or less spirally twisted when dry, erect-open when moist, about 2 mm. long, lanceolate, plicate but not rugose, very brittle, acute to acuminate, entire; costa strong, excurrent into a short point in most leaves; upper leaf-cells oblique, smaller and oval at the margins, narrowly oblong in the median portion, the juxtacostal oblong-linear and larger, linear at the base, the walls of all thicker than the width of the lumen; perichaetial leaves subclasping, long-lance-linear, up to 4 mm. long, often bearing a short hair-point which is usually broken off; monoicous; antheridial buds in the axils of the leaves; seta about 6 mm. long, smooth; capsules cylindric, the urn about 2 mm. long, more or less plicate when old and empty; peristome-teeth linear, with a distinct median line and marked with fine transverse lines.

TYPE LOCALITY: Jamaica.
DISTRIBUTION: Jamaica (*Maxon 10256*).

5. **Schlotheimia sublevifolia** C. Müll. Nuov. Giorn. Bot. Ital. II. **4**: 126. 1897.

Plants in wide, dark green mats, showing a close affinity to *S. torquata* but the leaves much twisted spirally; stems densely radiculose; leaves 2–2.5 × ± 0.5 mm., oblong-lanceolate, entire, more or less rugose above, shortly acuminate and mucronate; costa excurrent, occasionally as much so as in *Craspedophyllum apiculatum;* upper leaf-cells incrassate, subcircular to transversely elongate in and near the margins, 7 μ in their longest dimension, somewhat larger near the costa, longer and oblong to rectangular below, short-linear at the base; perichaetial leaves little different, more slenderly acuminate and less rugose; seta about 6 mm. long, smooth; capsules cylindric, about 3 mm. long; peristome not found.

TYPE LOCALITY: Bolivia.
DISTRIBUTION: Mexico (*Barnes & Land,* as *S. Mohriana*); Guatemala (*Steyermark 29947,* a long-apiculate form); Costa Rica (*Dodge & Thomas 6967*); Bolivia.

6. **Schlotheimia lancifolia** E. Bartr.
Bryologist **35**: 9. 1932.

Plants growing in wide, dense mats, dark brown except at the growing tips, the size and habit much as in the preceding species; leaves of primary stems erect, appressed when dry, 1.5 mm. long, narrowly lanceolate, acuminate; leaves of branches more crowded, erect-spreading when moist, spirally twisted around the stem with spreading, flexuous tips when dry, larger, reaching 2.5 mm. in length by 0.6 mm. wide, oblong-lanceolate, acuminate, carinate, neither plicate nor undulate, the margins narrowly reflexed on one side near the base, otherwise plane, entire or minutely crenulate in the upper half; costa brownish, 35 μ wide near the base, promin-

ently rounded on the back, ending just below the apex; upper leaf-cells smooth, rounded, incrassate, 7–9 μ in diameter near the costa, smaller near the margins, gradually elongating below to the rectangular, somewhat sinuous basal cells; perichaetial leaves scarcely differentiated; autoicous; seta reddish, smooth, 6 mm. long; capsules erect, symmetric, ovoid-cylindric, the urn 2 × 0.8 mm.; calyptra campanulate, deeply 4–6-lobed at the base, nearly smooth at the apex; operculum not seen; peristome-teeth reddish-brown, fleshy, recurved when dry; segments pale yellow, slightly shorter than the teeth, coarsely papillose-striate; spores rounded, irregular in size, papillose.

TYPE LOCALITY: Bark of tree, Ravenel's Forest, Highlands, North Carolina, alt. 4000 ft. (*A. J. Sharp 151*).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATION: Bryologist **35**: *pl. 3*.

7. **Schlotheimia angustata** Mitt. Jour. Linn. Soc. **12**: 223. 1869.

Schlotheimia sarcotricha C. Müll. Bull. Herb. Boiss. **5**: 196. 1897.

Plants in rather dense mats, dark green, brown below; secondary stems slender, little branched, about 1 cm. long; leaves somewhat twisted when dry, scarcely crisped, appressed, erect-open when moist; upper and perichaetial leaves 2.5–3 mm. long, from an oblong base, rather abruptly narrowed to a linear upper portion about equal in length to the broader base and very fragile, broken off in most leaves, entire, plicate, sparingly or not at all rugose; lower leaves often oblong-lanceolate and merely narrowly acute; costa nearly or quite percurrent, occupying ¼–⅓ of the narrow upper leaf; upper cells of the broad portion of the leaf rounded-quadrate to hexagonal, 6–7 μ in diameter, very regularly arranged, smaller and more rounded at the margins, below changing to elliptic, linear to rhomboidal at the base and incrassate, the walls as wide as the lumen, all smooth; seta 3.5–4 mm. long, smooth; capsules erect, cylindric, the neck short, the urn up to 2 mm. long, narrowed at the mouth, slightly sulcate; calyptra smooth, rather deeply lobed; operculum rostrate; peristome double, the outer teeth linear, thick, reflexed when dry, the inner linear, of equal length.

TYPE LOCALITY: On palm trunks, "Monte Campana," alt. 4000 ft., Peruvian Andes (*Spruce 113*).
DISTRIBUTION: Guatemala (*Standley 92160*); Andes of Peru and Bolivia.

10. **PLEURORTHOTRICHUM** Broth. Öv. Finska Vet.-Soc. Förh. **47**[15]: 1. 1905.

Plants moderately robust, slender, laxly tufted, green above, blackish below. Primary stems 4–8 cm. long, mostly prostrate, flexuous. Secondary stems erect, simple or branching, with sparse rhizoids, densely foliate. Leaves laxly erect-crispate when dry, erect-spreading when moist, narrowly to broadly lanceolate, entire or serrulate; costa slender, ending just below the apex; upper leaf-cells rounded, quadrate to short-rectangular; basal cells more elongate. Inner perichaetial leaves abruptly long-aristate from a broad base. Dioicous. Seta very short, lateral. Capsules immersed. Calyptra cucullate, hairy.

Type species, *Pleurorthotrichum chilense* Broth.

1. **Pleurorthotrichum cryptocarpum** E. Bartr. Ann. Bryol. **11**: 25. 1938.

Primary stems decumbent, up to 4 cm. long, densely radiculose; leaves about 3 mm. long, ovate-lanceolate, acuminate, carinate-concave, denticulate nearly to the base; upper leaf-cells moderately incrassate, rounded, short-oblong to subcircular, 10–12 μ in diameter, mammillose on both sides, elongate to shortly linear and incrassate near the base; perichaetial leaves 5–6 mm. long, abruptly aristate by the long-excurrent costa, denticulate above and with much longer linear cells at the base; ? dioicous; seta less than 0.5 mm. long; capsules ovoid, the urn 2.5 mm. long, smooth, without a neck; calyptra covered with flat, sharply toothed hairs 2–3 cells wide; peristome double, the outer teeth united into a low cylinder extending about 0.1

mm. above the mouth of the urn, the inner peristome pale, coarsely papillose, the segments from a low basal membrane, split or divided, about 425 μ high; spores brownish, papillose, 25–50 μ in diameter.

TYPE LOCALITY: Costa Rica, 950 m. alt. (*R. Cespedez 183*, type; also *A. Alfaro 165a*).
DISTRIBUTION: Known only from the type locality.
ILLUSTRATIONS: Ann. Bryol. 11: 26, *f. 1-6*.

11. **LEIOMITRIUM** Mitt. Phil. Trans. Roy. Soc. London **168**: 390. 1879.

Coleochaetium Besch. Ann. Sci. Nat. VI. 9: 354, as subgenus. 1879; Ren. & Card. Bull. Soc. Bot. Belg. **33**[2]: 121, as genus. 1894.

Leaves oblong to ligulate-lanceolate from a more or less decurrent base, carinate, obtuse to acute, serrate to finely papillose-serrulate above, the margins more or less recurved; costa strong, ending below the apex; leaf-cells rounded, strongly papillose. Sporophyte unknown in our species.

Type species, *Leiomitrium plicatum* (Beauv.) Mitt.

1. **Leiomitrium Standleyi** (E. Bartr.) Grout, comb. nov.

Coleochaetium Standleyi E. Bartr.; Grout, Bryologist **47**: 21. 1944.

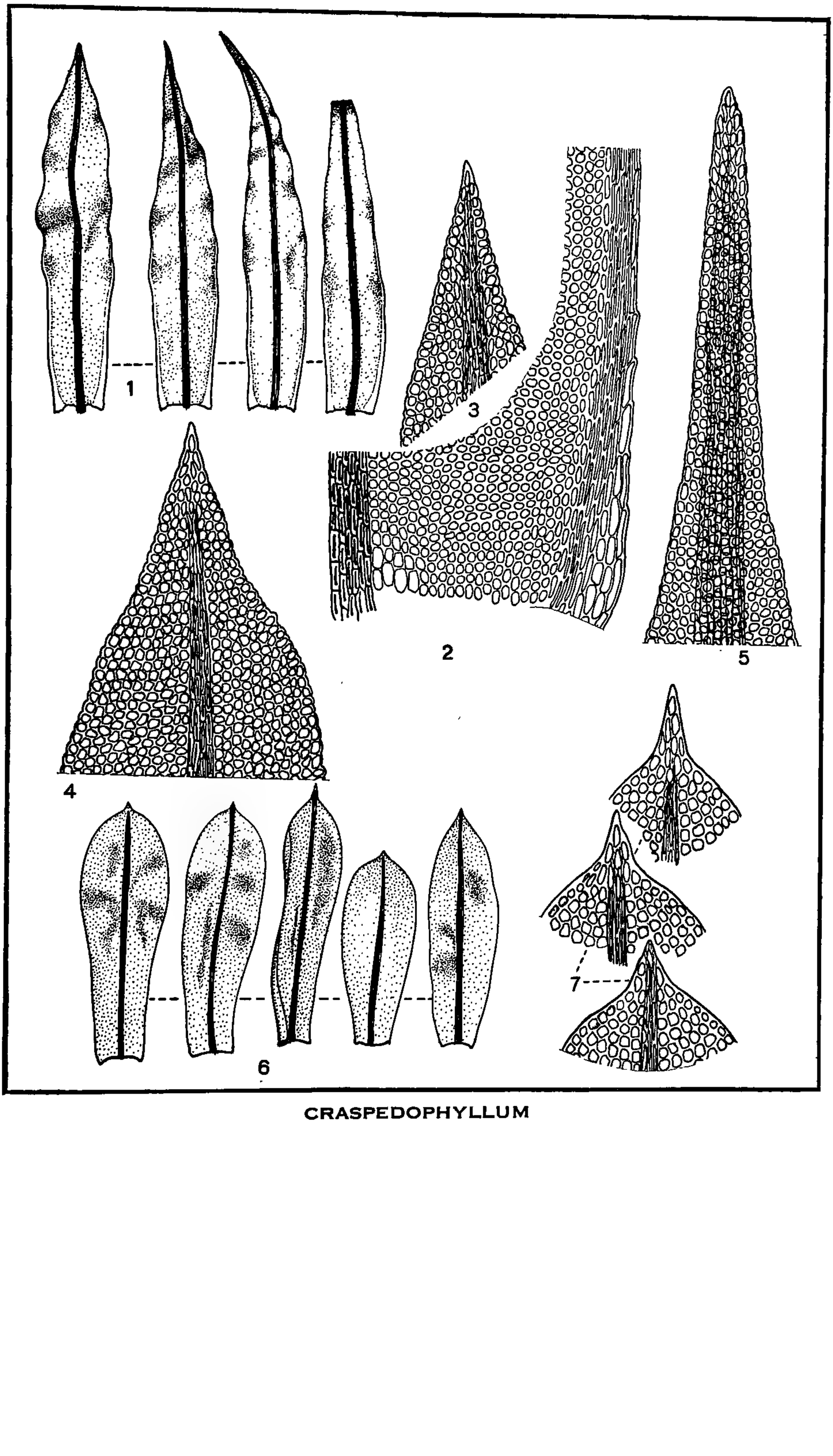
Plants wiry, laxly cespitose, dull sordid-green, brown below; primary stems creeping, radiculose, irregularly branched, the branches up to 5 cm. long, laxly and irregularly rebranched, obtuse or often attenuate and radiculose at the tips, flexuous when moist, variously curved and contorted when dry; leaves crowded, 5-ranked, appressed when dry, squarrose-spreading when moist, about 2 mm. long by 1 mm. wide, shortly lingulate-lanceolate from an ovate base, carinate above, the point fragile and usually broken off, acute, apiculate, strongly decurrent, the margins narrowly recurved below, sharply and finely papillose-serrate above; costa brownish, strong, ending below the apex; leaf-cells obscure, densely papillose with sharp, salient papillae, rounded, about 10 μ in diameter, in the decurrent angles large, rectangular, pellucid, strongly armed with high, spine-like tubercles up to 20 μ long; sporophyte unknown.

TYPE LOCALITY: Guatemala, Dept. Huehuetenango, Río Pucal, about 14 km. south of Huehuetenango, alt. about 1780 m. (*Standley 82293*).
DISTRIBUTION: Known only from the type locality.
PLATE 5.
NOTE: The decurrent leaf-auricles composed of large, rectangular, pellucid cells strongly armed with spinose tubercles are striking. This species is evidently near *Coleochaetium scaberrima* Broth. from Brazil, but the plants are wiry, laxly branched, and strongly contorted when dry, whereas the Brazilian plants are described as rigid and densely branched with strict branchlets.

PLATE 1

Figs. 1–5. *Craspedophyllum fragile* (Mitt.) Grout.
Fig. 1. Leaves. × 20. Fig. 2. Basal part of leaf. × 200. Figs. 3–5. Leaf apices. × 200.

Figs. 6, 7. *Craspedophyllum mucronifolium* (Hook. & Grev.) Grout.
Fig. 6. Leaves. × 20. Fig. 7. Leaf apices. × 200. (Leaves often more obtuse.)

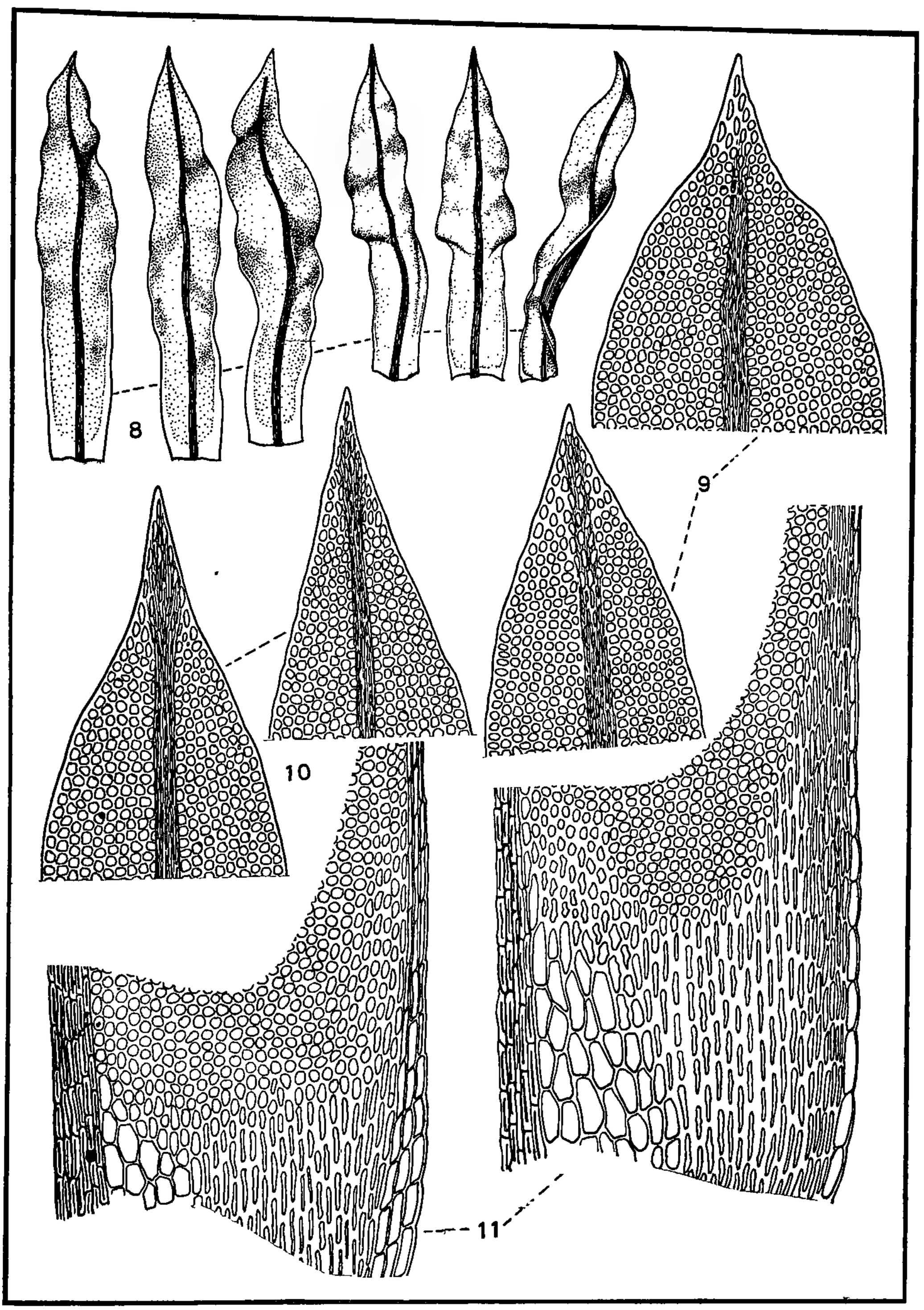


CRASPEDOPHYLLUM

Plate 2

Craspedophyllum Wagnerianum (C. Müll.) Grout.

Fig. 8. Leaves. × 20. Figs. 9, 10. Leaf apices. × 200. Fig. 11. Basal parts of leaves. × 200.



CRASPEDOPHYLLUM

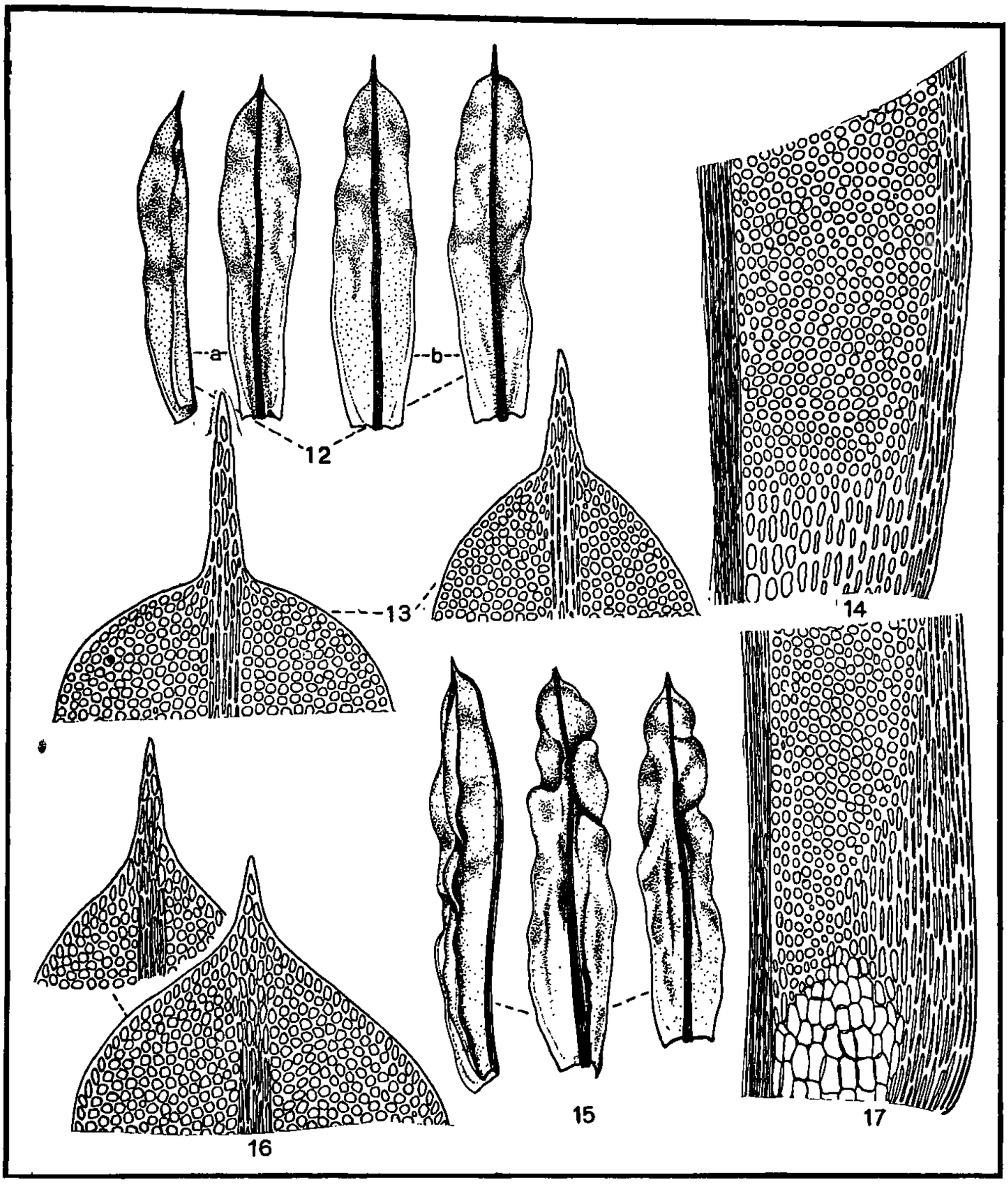
Plate 3

Figs. 12–14. *Craspedophyllum apiculatum* (Hook.) Grout.

Fig. 12. Leaves: *a*, lower; *b*, upper. × 20. Fig. 13. Leaf apices. × 200. Fig. 14. Basal and marginal leaf-cells. × 200.

Figs. 15–17. *Craspedophyllum undosum* (Card.) Grout.

Fig. 15. Leaves. × 20. Fig. 16. Leaf apices. × 200. Fig. 17. Basal and marginal cells. × 200.



CRASPEDOPHYLLUM

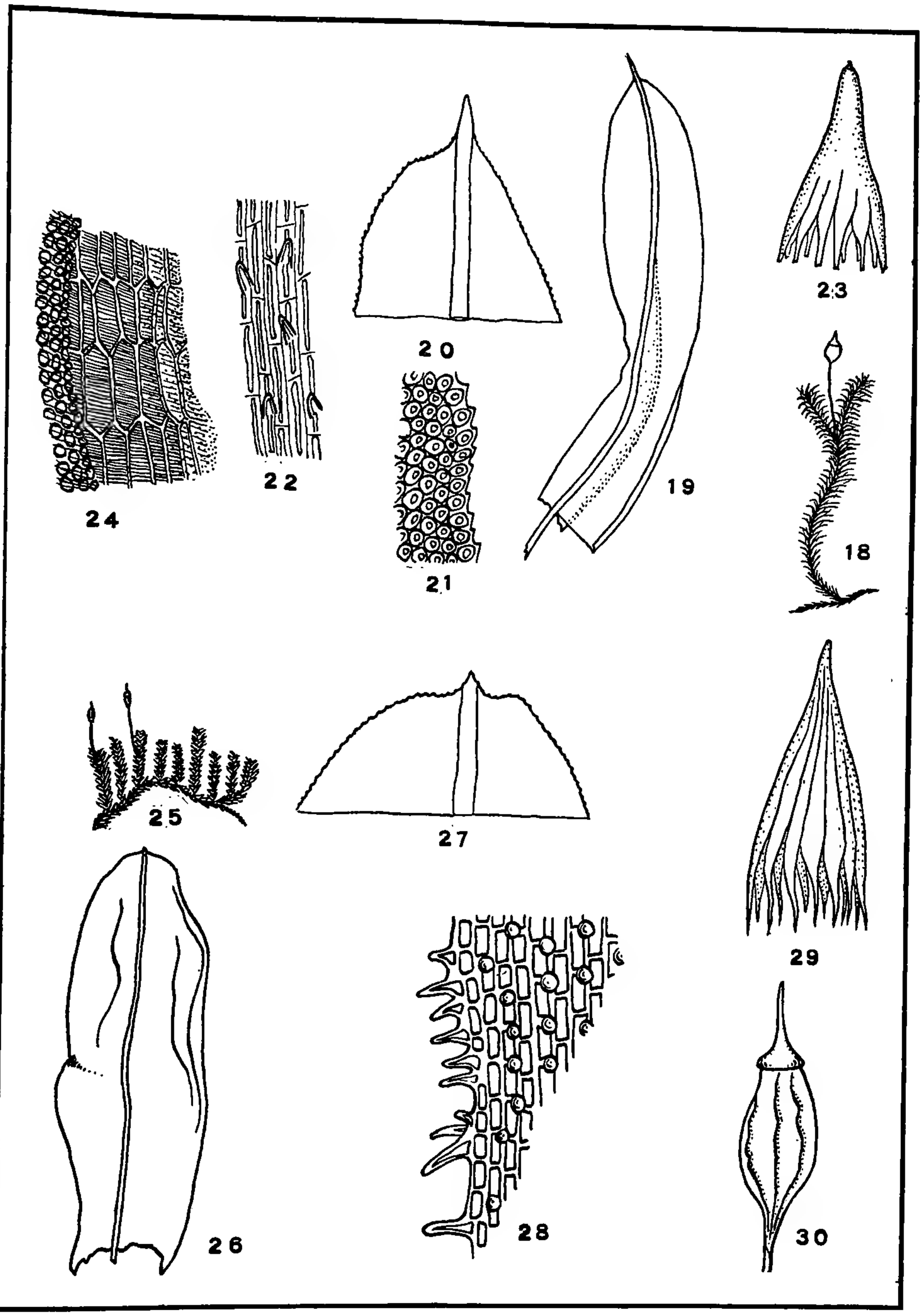
Plate 4

Figs. 18–24. *Macromitrium parvirete* E. Bartr.

Fig. 18. Moist plant. × 2. Fig. 19. Leaf. × 36. Fig. 20. Apex of leaf. × 160. Fig. 21. Upper leaf-cells and margin. × 400. Fig. 22. Median basal leaf-cells. × 400. Fig. 23. Calyptra. × 12. Fig. 24. Part of peristome. × 160.

Figs. 25–30. *Macromitrium altituberculosum* E. Bartr.

Fig. 25. Plant. × 1. Fig. 26. Leaf. × 30. Fig. 27. Apex of leaf. × 160. Fig. 28. Basal angle of leaf. × 400. Fig. 29. Calyptra. × 12. Fig. 30. Capsule. × 12.

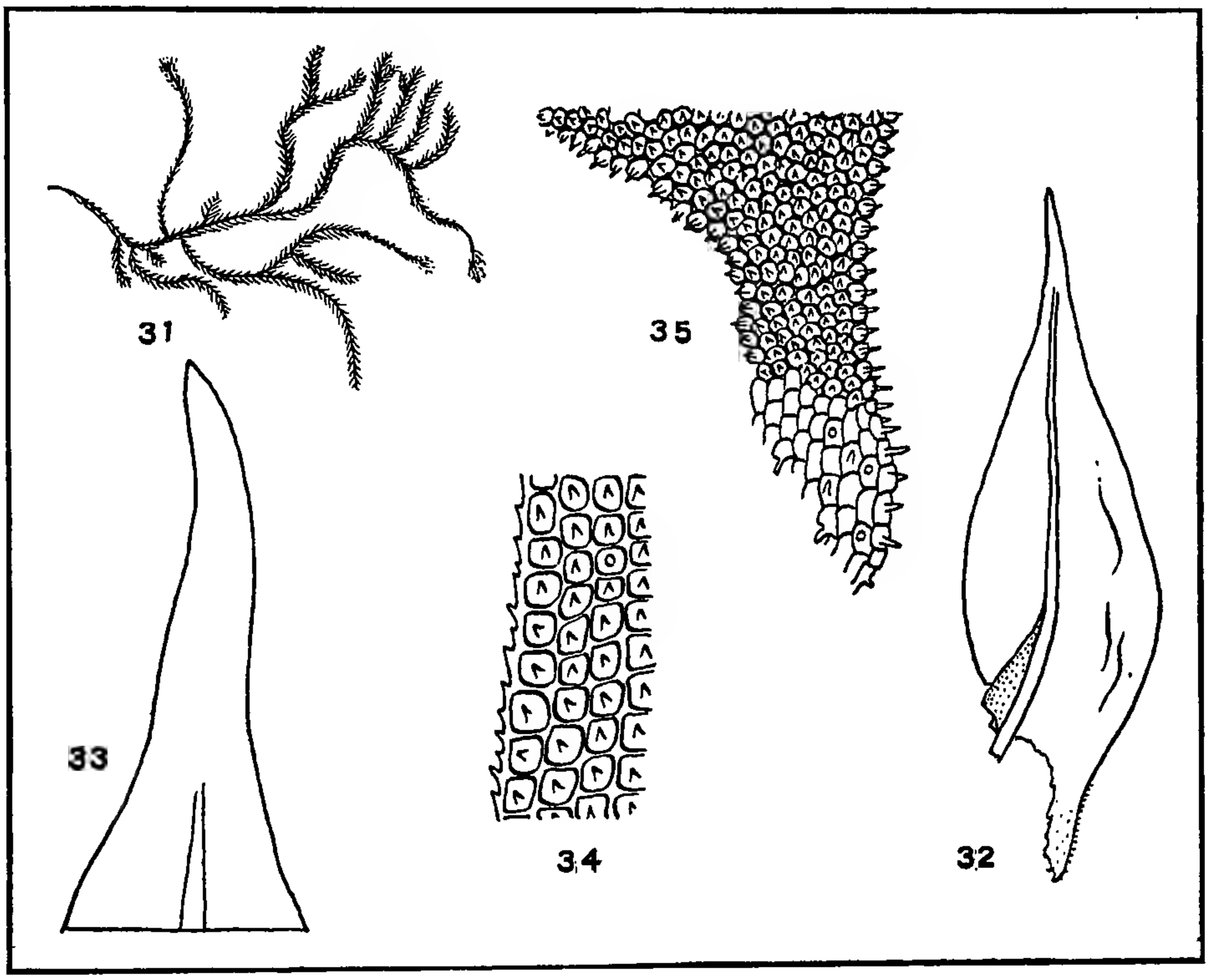


MACROMITRIUM

Plate 5

Leiomitrium Standleyi (E. Bartr.) Grout.

Fig. 31. Dry plant. × 1. Fig. 32. Leaf. × 30. Fig. 33. Apex of leaf. × 80. Fig. 34. Upper leaf-cells and margin. × 400. Fig. 35. Basal angle of leaf. × 160.



LEIOMITRIUM